ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
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Underground Mining of Aggregates
Main Report

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Executive Summary

Objective

This report examines the economic feasibility of underground mining for crushed rock aggregates in the UK, but particularly in the London, South East and East of England regions (the South East area of England). These regions import substantial volumes of crushed rock, primarily from the East Midlands and South West regions, requiring relatively long transport distances to market for this bulk commodity. A key part of the research was to determine whether or not aggregate could be produced and delivered to a local market from an underground aggregates operation at a cost comparable with that for production and transport of the commodity from traditional surface quarries located further afield. In essence the investigation asked – could the reduced transport costs compensate for the higher production costs underground so that underground crushed rock aggregates producers can compete with the established Leicestershire and Somerset surface quarries exporting to the South East?

Work Programme

The research effort involved establishing and verifying cost models for aggregates production, stone processing (sizing and sorting), haulage of product to market, environmental impact mitigation, health and safety, decommissioning and restoration. Another major element of the work was the re-examination of the BGS exploratory borehole and geophysical databases to identify potential areas of crushed rock aggregates resource at depth in the South East area of England. Land use pressure is typically higher in this area of England than elsewhere so another major part of the research was the identification of potential concurrent uses of land around the surface facilities of underground aggregates mines. The value, development costs for specific developments and determination of yields expected, from these uses were estimated. These were also used to investigate potential economic benefits associated with after uses of remediated surface land above potential underground aggregates mines and also for the new underground space that would be created. Key technical issues such as subsidence within relatively heavily populated areas of the South East area of England were also addressed.

Economic Results

The discounted cost of aggregate delivered at a discount rate of 10% was the metric used to appraise the options. This is the price of aggregate that leads to a zero net present value of project cash flows realised over the aggregates project life. The results show that the discounted costs of aggregate delivered to a local South East area of England market from an underground mine producing 3.5 million tonnes per annum (MTPA) of crushed rock aggregates, are in the range of £13.03 per tonne to £13.93 per tonne for the top six prospect locations. These are greater than the corresponding cost for a "reference" quarry in Leicestershire producing 3.5 MTPA (£10.95 per tonne), but lower than a "reference" quarry in Leicestershire producing 1.25 MTPA (£16.48 per tonne). These figures indicate that underground crushed rock aggregate mines located within the South East area of England may be able to compete for a share in the overall market by replacing / displacing aggregate imported from the quarries in Leicestershire and Somerset producing around or less than 1.25 MTPA. The surprise in these figures is not really that the more remote surface quarry has a lower discounted cost of aggregate delivered, but that the values for the quarry and underground mine are so close. The capital intensity for the development of underground aggregates mines was found to be higher than that required for surface quarries of comparable scale, by a factor ranging from 1.33 to 1.65 and thus may represent a disincentive for aggregates operators.

Carbon Emissions

The total carbon emissions of the 'reference' 3.5 MTPA quarry in Leicestershire were estimated at 9.28 kg CO_2/tonne aggregate delivered and this is to be compared with carbon emissions for the 150 metre deep underground mines serving the local market which were estimated at 9.31 kg CO_2/tonne delivered for a Bletchley prospect using an adit to access the sub-surface and 14.25 kg CO_2/tonne delivered for a prospect based on the Chitty bore hole using a shaft. Depth of the mine is a key factor in determination of the relative carbon emissions from each of the underground mining operations considered as electricity consumption for ventilation, pumping and winding is proportional to depth.

Recommendations

The current research generated seven principal recommendations which are discussed in detail in the concluding section of the report. These are:

- Appraise policy incentives for underground aggregates mining.
- Conduct an industry-wide consultation on findings from the current research.
- Obtain public and stakeholder opinion on new uses for underground space.
- Conduct research to reducing the energy intensity of mine services.
- Develop a deep level aggregates-specific drilling campaign.
- Investigate underground aggregates mines developed from existing surface quarries.
- Investigate underground aggregates as co-products of industrial minerals mining.

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1 Introduction

In the near future it is likely that the provision of hard rock resources suitable for crushed rock aggregates will give rise to increasing levels of conflict, particularly where the same hard rock has given rise to attractive landscapes which society wishes to protect. At the same time as reserves at surface quarries become depleted or existing permissions expire, the granting of extensions (whether in time or area) may become increasingly difficult to obtain. As a consequence, a future can be foreseen when the underground mining of aggregates might become not only more environmentally desirable but also an economic necessity in order to maintain security of supply. For aggregates operators, the economics of production and distribution from individual operations are pivotal to decisions relating to any new aggregates operation whether they be surface or underground operations, but the historical tendency in the UK has been to source crushed rock aggregates from surface quarries. Set against these contexts, this report examines the economic feasibility of underground aggregates mining in the UK.

1.1 Inter-regional flows of aggregate

Most surface hard rock resources suitable for crushed rock aggregates are located in the north and to the west of England, while a considerable proportion of the market demand is from London, the South East and East of England regions. This results in considerable inter-regional transport of crushed rock aggregates, particularly from Leicestershire and Somerset into the southern and eastern parts of England (referred to in this report, for convenience, as the "South East area of England", but representing an area greater than the South East Region) (Table 1.1), and defines the target aggregates market area on which focus was maintained in the research. There is also a significant movement of crushed rock aggregates from the East Midlands region into the North West and West Midlands, which implies that the latter regions also have insufficient production capacity to meet their needs, however these destinations were not considered as part of the work presented here.

Table 1.1: Flows of crushed rock aggregates within and between regions in England and Wales, 2005 (Mankelow et al., 2005)

,000 tonnes	Region To													
Region From	London	East of England	South East	West Midlands	North West	Yorks & Humber	North East	Wales North	South West	East Midlands	Wales South	Total Production	Exports	Exports %
North Wales	79	55	168	5	2943	0	0	2320	0	0	1	5571	3251	**58.4**
East Midlands	1670	4189	1087	3625	4517	975	0	1	17	12357	2	28440	16083	**56.6**
South West	1443	480	3810	333	3	3	0	0	15932		153	22157	6225	**28.1**
East of England	0	371	0	0	0	0	0	0	0	115	0	486	115	**23.7**
South Wales	127	64	140	1533	111	3	3	116	416	23	8376	10912	2536	**23.2**
Yorks & Humber		33	3	12	1225	9929	458	37	0	258	0	11955	2026	**16.9**
North West	0	0	2	13	7728	331	47	10	702	33	0	8866	1138	**12.8**
South East	0	7	1085	23	0	0	0	0	80	42	0	1237	152	**12.3**
West Midlands	0	58	22	4139	87	20	0	34	7	144	4	4515	376	**8.3**
North East	7	0	1	3	21	25	5359	1	1	3	0	5421	62	**1.1**
London	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**
Total Consumption	3326	5257	6318	9686	16635	11286	5867	2519	17155	12975	8536			
Total Imports	3326	4886	5233	5547	8907	1357	508	199	1223	618	160			
Imports %	**100.0**	**92.9**	**82.8**	**57.3**	**53.5**	**12.0**	**8.7**	**7.9**	**7.1**	**4.8**	**1.9**			

Notes: Indigenous production volumes are de-emphasised with grey shading. Boxed area shows inter-regional crushed rock volumes of principal interest in the work presented here.

For a low value, bulk commodity such as aggregate, transport is a major part of the end cost and therefore distances and modes to market have an effect on the economic feasibility of an aggregates prospect. Identifying a location, or locations, for an underground aggregates mine as close as possible, or within, the London, East and South East regions of the country would result in shorter transits to the main markets.

Thus an important aspect of the research has been to establish whether the economic benefit of these reduced aggregate transport distances for underground mines within the South East area of England would permit such operations to compete with the delivered cost of aggregate from surface quarries located in the South West and East Midlands regions. Reduced CO_2 emissions are to be expected with reduced transportation distances to market for bulk products, and these are quantified in the research undertaken too.

In addition to the market proximity advantage potentially available for new underground aggregates operations, the research also set out to consider the following potential advantages of underground mining for aggregates, over surface quarrying.

1.2 Potential advantages of underground mining of aggregates investigated

a) The ability to extract hard rock from areas without disturbing the surface landscape would lead to a reduction in visual intrusion, habitat disturbance and land-use changes in comparison to surface quarrying. However, even with crushed rock aggregate won from the sub-surface, surface expression of aggregates production will be inevitable. present in the form of workshops, offices, stockpiles and comminution and screening plant, etc. The relative reduction in impact arises from i) the absence of large surface excavations and associated haul road infrastructure, ii) the requirement for primary crushing in the sub-surface for transport to surface either by skip or conveyor and iii) reduced need for soil/overburden mounding. Despite the fact that such impacts are reduced, ongoing surface expression will mean that there will be ongoing planning challenges.

b) There is potential for enhanced revenues for the aggregates producer by putting the land surface above an underground aggregates operation to economic use during extraction operations. This issue is discussed in detail later on in the report (Section 5.6).

c) Improved security of supply arising from an increase of the total aggregate resource available through the additional consideration of underground resources.

d) Increased provision of underground space (after extraction), in areas that are close to high population density areas (that coincide with high aggregates demand centres). This space could be used for underground storage, warehousing or other business uses, with any ultimate use depending on geological, hydrogeological and planning constraints or requirements.

e) The containment of some of the noise, dust and vibration (from air-over pressure) associated with operations of drilling, blasting, loading and hauling of rock. Planning challenges will still be encountered in the area of ground vibration for underground mines, but it is possible to design supported mine layouts where the probability of subsidence is significantly diminished. (Noise and dust associated with processing the rock into aggregates would not be removed if the processing equipment was located on surface, and ground vibration would still need to be considered).

f) With underground mining, there is no need to strip and store soils and overburden from above hard rock resources. This provides further potential environmental benefits by removing the dust, noise and fuel usage caused by soil stripping activities. It is also expected that underground mines will offer a reduction in land restoration activities and costs.

1.3 Additional issues investigated

As the work progressed, additional issues arose that have also been subjected to investigation.

- Is it better for the underground aggregates operator to procure the freehold for the whole area of land that is undermined by aggregates production operations, or should the mineral rights be procured from the freehold owner and a royalty to the freehold owner be paid.
- What are the typical physical attributes of operating practice for surface quarrying, with which the option of underground mining of aggregates could be compared? This issue became important in addressing items a) and b) listed above. Reports on UK quarry operating practice held within the library of the Camborne School of Mines were consulted to establish various metrics to assist with the establishment of production cost models for surface quarries. In particular these sources were used to establish typical values for the total land take of quarrying operations as a function of their production rate. Ultimate pit areas were also recorded, where reported, so that the land area required to accommodate surface quarry static plant (e.g. secondary crushing, screening, stockpiling, etc.) could also be established as a function of quarry production rate. The latter function was also adopted to represent the surface expression of underground aggregates mines that, broadly, would still require land for these surface facilities.
- Where are potential aggregates resources located? Clearly they are at depth, but at which locations does suitable host geology rise closest to surface (to minimise primary access costs) and what are the specific production and distribution economics at these potential sites?
- How extensive may the potential areas of resource be? While the number of boreholes within the South East area of England is in the thousands, there are relatively few that penetrate through to the solid geologies at depth that may potentially host aggregates resources. Thus careful appraisal of continuity of the geology around intersections was undertaken based on previous and new interpretations of the borehole data, and geophysical data where available. However, the sparseness of available data means

that any tonnage estimates set out in this report must be viewed as subject to considerable uncertainty, and thus should not be over-interpreted.

1.4 Project Objectives

The objectives of the research were threefold:

A. To assess the costs of underground aggregates mining taking the environmental and social costs, energy and carbon implications, and geographical and after-use aspects explicitly into account and to compare these costs with an equivalent surface quarrying option.
B. To isolate circumstances (if any) that bring about equivalence in the choice between an underground aggregates mine located fairly close to a population centre and a quarry located more remotely from a population centre.
C. To use these circumstances to identify the areas that potentially contain aggregate resources within the South East area of England that could be exploited using underground mining methods.

1.5 Overview of the research methodology

1.5.1 Specification of mining and quarrying operations

An early task of the research concerned the specification of the operating conditions, capital equipment, personnel complement and the primary access type for different underground mining methods, each specification executed over a range of production rates. This specification process was extended to surface quarrying operations, informed by a survey of UK quarrying practice by means of review of a database of quarry operational reports held within the library archive of the Camborne School of Mines. The Metso Bruno processing flow sheet design and mass balancing software (Metso, 2009) was used to establish a set of specifications for a series of generic aggregates processing plants designed for increasing production rates spanning those considered in the stone winning specifications.

1.5.2 Stope design for underground workings

An important potential economic benefit of aggregates produced from underground mining operations is that such operations may be located closer to historical high aggregates demand centres because the aggregate comes from depth. High aggregates demand centres also tend to be centres of economic development and hence relatively dense population. Naturally, planning authorities will be concerned about the propensity of any underground mining method to induce subsidence in such areas and whether ground vibrations induced by underground blasting would cause nuisance.

Surface expression of the mining operation through subsidence was considered an unacceptable outcome of underground aggregates mining in these areas, which naturally led to the selection of supported mining methods only, specifically i) room and pillar and ii) long hole open stoping. Identifying these mining methods significantly reduced the number of different methods of working that needed to be specified.

Having selected these mining methods, stope design comprised determination of the opening dimensions and the supporting pillar dimensions such that the factor of safety against pillar failure was 1.8 in all cases. This is a value that implies that surface subsidence due to pillar failure is unlikely, and would mean that the workings should be sufficiently stable to support marketable after uses of the sub-surface space on completion of the aggregate production operations, subject, among other considerations, to the possible ongoing presence of groundwater. The opening dimensions were matched to larger scale underground mining equipment that could sustain high levels of crushed rock aggregate production, and the pillars sized accordingly.

No significant research effort was expended on investigations of blasting vibrations, as this was eliminated as a first order potential impact for the following reasons. Firstly, for underground mining operations using the maximum instantaneous charge detonated in a production round will be substantially smaller (~5kg) than that customary for surface quarrying operations (~70kg) and for this reason alone, the magnitude of peak particle velocities will also be substantially lower, for the same clearances (>300-600 meters typically, in depth, for underground workings, and in plan for surface workings). Secondly, the attenuation of ground vibrations introduced by explosives at depth is greater than the attenuation of ground vibrations introduced by explosives at surface. Thus although it is inevitable that ground vibrations from underground aggregates mines will be sensed in buildings that may overlie production blasts at depth, the magnitude of the peak particle velocities at surface will be substantially lower than for surface quarries, due to this depth attenuation effect.

1.5.3 Development of a standard costing system

A comprehensive standard costing system was developed for capital equipment items, their maintenance and overhaul, their spares as well as additional consumable items such as tyres, lubrication, power and fuel. In addition the standard costing system also specified maintenance, overhaul and replacement schedules for each item of equipment as well as rates for workforce and management personnel of all grades. The standard costing system was based on that of Western Mine (2006a and 2006b) but appreciably modified to reflect UK labour rates and to isolate cash costs from non-cash costs, such as depreciation, that may otherwise been double counted in valuation calculations.

The standard costing system was then used to estimate both the capital and operating costs associated with each of the underground mine, surface quarrying and processing plant design specifications.

For the underground mines, the primary access development options (shaft or adit/decline, wet development or dry) were specified and costed separately such that the cost models established were sensitive to the depth of workings.

1.5.4 Refinement of the production cost models

Once these cost models and the underpinning standard costing system were established, these were reviewed in detail for their accuracy and relevance to the UK aggregates production industry by the industry partner in the project, OMYA UK Ltd. Feedback from the industry partner was then used to modify either the design specifications of the underground mine, quarry or process flow sheets, or the rates used in the standard costing system. In this way, the research team endeavoured to ensure that the production cost basis on which subsequent investigations were based, was as accurate as possible without the need for disclosure of commercially sensitive data.

1.5.5 Development of an aggregate haulage cost model

Scania (Great Britain) Ltd, manufacturers of road haulage trucks, were consulted at length to inform the development of capital and operating cost models for road haulage trucks. Hence, road freight haulage rates for the distribution of crushed rock aggregate product were derived. An aggregates operator located in the South West region of England was consulted at length and invited to assess the haulage cost models produced by the research team and to comment in particular on their accuracy and relevance to the UK aggregates sector. Feedback from this operator was used to refine the aggregate haulage cost model used in the later part of the study.

1.5.6 Development of other cost models

Additional costs were compiled relating to environmental mitigation, health and safety compliance, decommissioning and restoration processes, for both surface aggregates operations and underground aggregates mines. These cost models were passed to the OMYA UK Ltd for review and then refined using this feedback, as described for the production cost model refinement. Following this, the compiled costs were assimilated into overall cost models.

1.5.7 Review of potential areas of aggregates resource at depth

The British Geological Survey, a partner in this research project, maintains a geological archive which includes records of most boreholes drilled in England greater than 30 m depth, and a substantial number of shallower boreholes. They also hold interpretation maps of the pre-Permian bedrock of the country and details of various investigations carried out using seismic or other geophysical technologies. The BGS also holds a database of all existing and many historical mineral extraction sites. These data were re-evaluated by BGS geologists to identify the locations, depths, and extents (where possible) of potential aggregates prospects around the high aggregates demand area of London and the South East area of England.

1.5.8 Prospective site screening

The locations of underground aggregates prospects identified previously were considered alongside additional spatial constraints that would inhibit underground mine development such as environmental designations and the locations of urban areas. The results of Geographical Information System (GIS) spatial analyses were then supported by means of virtual site visits using the Google Earth data set. These site-visits also proved useful in establishing the current land use so that appropriate rates for land value at the prospect sites could be determined, and for assessment of the feasibility of rail head installation which could permit both inter- and intra-region distribution of aggregate by rail. The borehole locations remaining after this screening process are referred to subsequently as “prospects” although neither the exact location nor legal permission to work these sites is implied by this term.

1.5.9 Investigation of concurrent uses and after uses of land above underground aggregates operations and also after uses for underground space.

An important potential benefit of underground aggregates mining is that the land above the exploited area may be put to an economic use during the extraction phase, such that there are opportunities for enhanced revenues in comparison to a surface quarrying method where the land within the exploited area is effectively sterilised during extraction.

Possible concurrent land uses above underground mines were investigated for their potential and values were assigned to some of these uses by reference to UK region specific rates for land values, development costs and rents published by the Valuation Office Agency. Also specific exemplars (and values) for civil or civic concurrent uses for land were drawn from HM Treasury’s published database of Private Finance Initiative (PFI) projects.

These sources were also used to establish potential sale values of the remediated land above underground aggregates mines at the end of the mine life.

The BGS has conducted extensive research on the uses of underground space and the demand for such uses. The results of this research were used to identify a range of potential end uses for underground space arising from underground aggregates extraction and the sale value of the underground space was estimated using the same sources as for concurrent uses.

1.5.10 Assimilation of all costs and valuation of the options

Costs and values established from earlier parts of the research programme were assimilated within a prospect evaluation tool, and the timings of the various cash costs were programmed such that discounting valuation methods could be adopted. Each of the prospects identified earlier were evaluated and compared to the results of similar valuation computations undertaken for a reference set of surface quarrying operations. As a model for crushed rock aggregate haulage rates had been established, the valuation measures used in the following appraisal took account of the typically longer distance of the surface operations from the target market considered in the South East area of England (i.e. the M25 around London). Detailed consultations with aggregates operators who are actually importing crushed rock aggregated into the target area were undertaken, and the haulage model developed as part of this work was fully exposed to them. Feedback from them was used to refine the model to match with their expectations. Our model does consider rail transport where this is appropriate.

The valuation measure adopted was the discounted cost of aggregate delivered (DCAD) to the target market (see section 3.9). This measure was firstly used to identify the optimum method of exploitation of each prospect site, by conducting a search for the minimum discounted cost of aggregate delivered across the range of production rates, the options for primary access and the options for mining method types. For each prospect, the results of this optimisation process were taken to be the long-term average costs of crushed rock aggregate production and delivery.

1.5.11 Economic appraisal

As the various prospect sites varied in their distance to market, varied in their depth to the target aggregate horizon, varied in their access to infrastructure, etc., the set of long term average costs for the set of prospects varied too. The next stage of the work involved ranking the prospects in order of increasing long-term average cost such that the ordered ensemble effectively represented a long term supply curve for the underground aggregates sector in the South East area of England.

Having established a supply curve for underground aggregates production, the behaviour of this part of the supply side of the crushed rock aggregates market was assessed in the face of competition from more remote surface quarrying operations, with the assumption that together they are characteristic of a competitive market.

The main part of the research concluded using these economic arguments, to determine the set of underground aggregates mine prospects that could deliver aggregate to market at a price competitive with the quarries exporting crushed rock aggregate to the same region.

1.5.12 Assessment of carbon emissions

Finally, the detailed nature of the specifications for the underground mining and quarrying methods required for accurate assessment of cost, was equally suited to estimation of the CO_2 equivalent emissions of each type of aggregates production operation. Fuel and electricity consumed in the production, processing and aggregate haulage operations were identified and the specific carbon emissions factors within the published DEFRA / DECC guidelines (AEA, 2009) were adopted to quantify the carbon emissions. In addition, significant amounts of ammonium nitrate are used as explosive in both underground mining and surface quarrying operations. Ammonium nitrate is a bulk material requiring appreciable amounts of energy for manufacture as well as requiring the consumption of methane as one feedstock. Consequently the embedded carbon in the ammonium nitrate explosive used in aggregate production was added to the emissions arising from fuel and electricity use to arrive at a final estimate of $CO_{2,eq}$ / tonne aggregate delivered, for both quarries and underground mines, and these were compared.

1.6 Structure of this report

The main body of this report focuses on the use of financial appraisal and valuation models developed in the research, that assimilate all auxiliary information and data, in order to arrive at the main research results. The underpinning data gathering, information assimilation and auxiliary analyses undertaken as part of the project are reported in full, but are deferred to Appendices, in order that the main results of the work are not obfuscated by the detail and volume of this supporting material.

2 Re-evaluation of existing geological data around a high aggregates demand area

2.1 Introduction, Assumptions and Uncertainties

The British Geological Survey (BGS) holds an extensive geological archive which includes records of the majority of boreholes drilled in England over 30 metres depth and a large number of shallower ones, interpretation maps of the pre-Permian bedrock of the country, and details from various investigations carried out using seismic or other geophysical technologies. The aim of this part of the project was to re-evaluate all these pieces of geological information to identify possible locations ‘around a high aggregates demand area’ where underground mining for aggregates could potentially take place.

For the purpose of this research, the ‘high aggregates demand area’ has been assumed to be represented by central London. Consequently the re-evaluation of existing geological datasets has been broadly limited to London, the South East and East of England regions, although some of the areas identified do cross the border into neighbouring regions.

This research focuses on the potential for underground mining for aggregates from a ‘greenfield’ location and specifically excludes the option of converting to underground mining from an existing surface quarry. In the medium term, however, it is likely that the latter could be considered as potentially economic because the site infrastructure and transport links are already in place and thus the requirement for capital investment is reduced. Although locating a ‘greenfield’ underground mine closer to the main demand centre would have the benefit of reduced transport distances, and consequently savings in transport costs, these costs are categorised as operating costs and not capital investment and these are easier for a commercial company to provide. Additional investment in an existing site, that will increase the available resources and extend the site life, is also easier for a company to justify to its stakeholders

Similarly this research has not considered underground mining for aggregates from existing mines established to extract other minerals such as coal or gypsum. In some of the potential locations identified there is the possibility of working ‘co-products’ or ‘by-products’ of other minerals, for example coal seams occur within beds of sandstone. Again these have specifically not been included.

The geology of England is such that the rocks close to the surface in the southern and eastern parts of the country are generally of Triassic or younger ages (with a maximum age of approximately 210 Ma). Most good quality hard rock aggregates come from formations of Carboniferous or older age (with a minimum age of approximately 300 Ma). However, below the younger rocks in the south-east of England older formations can be located and it is true to say that if you go deep enough you will eventually find good quality hard rock which is likely to be suitable for use as aggregates. That said, it is clearly more expensive to mine at greater depths and some of these deeper, older rocks are likely to be too deep for an underground aggregates mine to be economic. Consequently, a maximum depth of 1000 m has been used in this research when examining the geological datasets. This removes much of the area immediately around London because the thickness of younger rocks is greater than this maximum.

When searching for rock types that may potentially be suitable for use as aggregates, consideration has been given to the principal rock types that are currently worked at the surface in England. These are Carboniferous age limestone, various types of igneous rocks (for example granite, basalt or andesite) and older, stronger sandstones or ‘gritstones’ (coarse grained sandstones). The latter are often some of the most valuable aggregates because they have high ‘polished stone value’ (PSV). This is a measure of friction or skid-resistance, which is created by the micro-texture on the surface of the rock. A high value means the rock is not easily worn smooth (or ‘polished’) and consequently it may be particularly suitable for road surfacing applications because it retains a high degree of skid resistance for a longer period of time. A value of 60 or above is considered to be good. However, many sandstones are too friable for such uses and therefore other properties also need to be considered when assessing the suitability of rock for aggregates uses.

Many rock types with lower PSVs are suitable for other applications, including the lower layers in road construction and in concrete for structures. In particular, Carboniferous limestones remain the most extensively worked aggregates resources in the country, with significant quantities extracted for these purposes in Somerset and Derbyshire. Furthermore, many igneous rocks are particularly durable and worked in large volumes in Leicestershire and western Scotland. There are many different measures of rock ‘strength’, which are conducted through standardised tests, including ‘Aggregate Impact Value’, ‘Aggregate Crushing Value’ and, as used here, ‘Aggregate Abrasion Value’ (AAV). Published values for individual quarries, and therefore rock formations, are not always available however typical values based on actual data held by the BGS are described in this research. With AAV the lower the value the more resistant the rock is to abrasion and in general a value of 10 or below is considered to be good. The accurate correlation of aggregates test results with the measurement techniques used during the logging of boreholes has not been proven and this represents an area for potential further research.

It is likely that all rocks which are worked for aggregates at the surface have their equivalent in the sub-surface. However, this does not mean that the qualities of the sub-surface rocks are identical to those known as the surface. Rock formations can have considerable variation across an outcrop and it is likely that similar or greater variation will exist at depth. Deeper burial of most rock types results in a more indurated (harder) rock and consequently rock types which at the surface are too weak or friable for use as aggregates could become more suitable at depth. In some cases rocks which appear to have been deeply buried, at some point in their geological history, have subsequently been uplifted and are now located much closer to the surface, an example considered in this research is the Jurassic age limestone in the Weald Basin (approx 161 to 175 Ma).

In some boreholes 'sonic interval velocity' has been recorded using a 'down hole' sonic tool. This tool records the fluctuating velocity of sound in the rocks penetrated in microseconds per foot. These can be re-calculated as metres per second (ms^{-1}) and the average for the identified interval can be plotted against depth. Nearly all such graphs show an increase in velocity with depth, which represents the reduction in porosity and permeability that accompanies compaction during burial. The correlation of this sonic velocity to engineering parameters would be a useful technique but requires further research. It is the measurements of sonic velocity in the Weald Basin that suggests tectonic uplift has resulted in unusually dense and low porosity Jurassic limestone within a reasonable depth as discussed later.

An attempt has been made as part of this project to delineate areas that contain rocks in the sub-surface which may be of interest for use as aggregates. Although the skills and expertise of BGS geologists have been employed to provide this delineation, it must be borne in mind that the boundary lines of the areas shown are inferred and as a consequence will not be completely accurate. Any future project to develop a potential underground mine for aggregates would have to conduct extensive additional drilling in order to prove the existence, extent and quality of the proposed resource before progressing to a full feasibility assessment. Neither the BGS nor the Natural Environment Research Council (NERC) gives any warranty, condition or representation as to the quality, accuracy or completeness of the information contained in the following diagrams, nor its suitability for any use or purpose.

There are many uncertainties involved in any delineation of rock types in the sub-surface:

- Borehole data indicates the rock types present at one point only; the delineation of rock types between boreholes is therefore a matter of interpretation.
- Similarly, geophysical information from seismic lines provides information only relating to that precise line; the indication of rock types elsewhere is entirely interpretation.
- Structures can vary considerably with distance, for example the degree of dip in strata can vary, volcanic sills can suddenly change their horizon or split into a number of 'leaves', etc and this causes problems with interpretations.
- Away from fixed points or lines, interpretation can sometimes be aided by aeromagnetic or gravity anomaly maps, however this is still 'interpretation' and has associated uncertainties.
- As a consequence of the above, the inferred boundaries to the areas shown on the following diagrams have varying degrees of confidence, and are not the same from one delineated area to another.

There is also potential confusion over the use of the term 'resources' in research such as this. For clarification the following definitions are important (from Gunn & Lusty, 2008):

- Resource base : "all of a mineral commodity contained in the Earth's crust"
- Resource : "a concentration of a mineral commodity of which the location, grade, quality and quantity are known or estimated from specific geologic evidence"

- Reserves : "the quantity of a mineral commodity … which are both known and profitable to exploit with existing technology, prices and other conditions". These other conditions also include a valid planning permission in the UK.

By these definitions, the delineation of areas shown on the following diagrams are somewhere between 'resource base' and 'resource'. Strictly speaking they are not formally a 'resource' because their grade and quality are largely unknown, whilst any estimation of quantity is very approximate. Although the term 'resource' can be further sub-divided in order of increasing geological confidence from 'inferred' to 'indicated' and finally to 'measured', it is considered more appropriate to refer to the areas shown as 'potential areas of resource', i.e. areas where resources may be found.

A summary of the key borehole information used in subsequent elements of the research is presented in Table 2.1, located at the end of this major section.

2.2 Potential Areas of Resource – Carboniferous Limestone

The limestones and dolomites of Carboniferous age (approx 359 to 326 Ma) are quarried extensively at outcrop, and have been mined underground in the past. Official figures for the extraction of limestone do not separately distinguish Carboniferous from other aged limestone, however, in 2007 more than 17 million tonnes of limestone were extracted from Derbyshire (which is likely to be exclusively Carboniferous) and more than 11 million tonnes from Somerset (which is mostly Carboniferous) (ONS, 2008).

Data on physical properties of Carboniferous limestone are less frequently published than for igneous rocks or sandstones because generally limestones have a lower PSV and are therefore not suitable for road surfacing applications. Where BGS have values for PSV in active Carboniferous limestone quarries, they range from 41 to 48. The limited data available for actual quarries show an AAV ranging from 10 to 13, but a value of 9 is considered more typical for the outcrops in Derbyshire.

Although, these rocks extend into the subsurface, they have not been uniformly preserved. Carboniferous Limestone is found around Cambridge, Northampton and in the southern part of the Berkshire Syncline, but has been eroded from large parts of the intervening ground. The exact extents have not been proved. It is also present beneath the Coal Measures of the Kent coalfield and as a broad band extending east from the Mendips in Somerset to offshore in East Sussex. This latter band is deeper than 1000 m from the surface in most locations but rises to shallower depth in an area south of Brightling. All these potential areas of resource are shown in Figure 2.1.

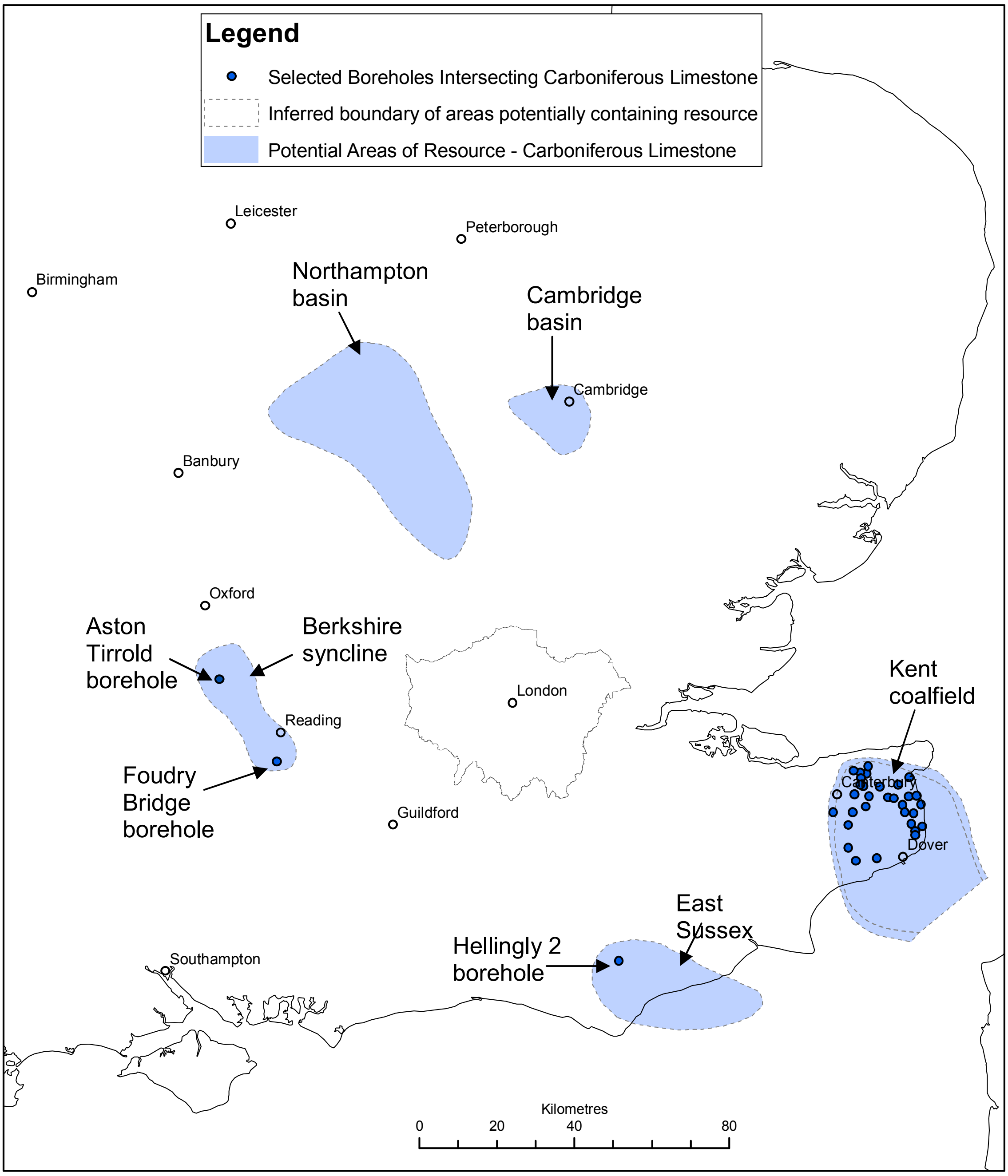


Figure 2.1: Potential areas of resource for Carboniferous Limestone

2.2.1 Cambridge-Northampton basin or basins

There are two areas of poorly defined Carboniferous limestone subcrop in the south Midlands (Cambridge and Northampton-Bedford areas). The proposed (Smith, 1985) southern extents of these subcrops have not been drilled. Although the facies is unfavourable in the boreholes drilled in the north of these areas (where mudstones, sandstones and conglomerates predominated and limestone content was low) the southern parts are likely to have improved lithology because the main marine transgression came from the south. Here the facies is likely to be less marginal and include thicker limestone beds. However, there are no sonic velocity data here and the lack of depth of burial (as far as can be ascertained) may have produced inferior physical properties even if clean limestones are present.

2.2.2 Kent Coalfield

Carboniferous limestone occurs on the western and northern margins of the Kent Coalfield at about 300 m depth. It is also present beneath the whole coalfield, which extends offshore, at levels down to 1300 m. The structure of the Kent Coalfield, as far as can be determined, is shown on the cross sections at Figure 2.2 and Figure 2.3. The youngest Carboniferous limestone is dated as Holkerian (approx 339-342 Ma) (Mitchell 1981), showing that pre-Westphalian erosion has removed higher beds (the Westphalian stage is dated approx. 318-305 Ma). The sonic velocity data indicates a hard, low porosity sequence, but the top of the limestone is liable to be karstified, that is, penetrated by fissures filled with younger rocks and larger cave systems. The old coal exploration records in the north of the coalfield are not reliable enough to base aggregates exploration on without further drilling.

The currently existing Minerals Local Plan for Kent includes the following policy, which has been 'saved' during the transition to a Minerals Development Framework, "Subject to the County Council being satisfied that the impact of the development in respect of the local environment, water resources and transport is acceptable and that requirements of policies CA16 to CA26 can be met, favourable consideration will be given to proposals to mine and process limestone from within the appropriate areas identified on the proposals map." (Policy CA13: Kent County Council, 2007). The Minerals Local Plan also specifies that the "limestone prospect" is for a location "west of Richborough Power Station" which is located in the north-east corner of the Kent coalfield (Kent County Council, 1993).

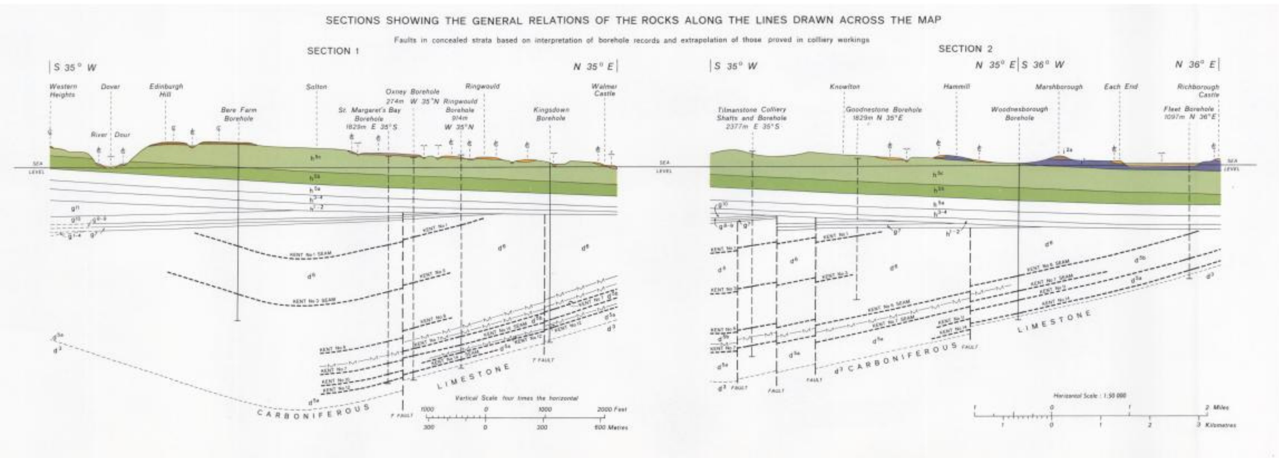


Figure 2.2: Cross-sections extracted from the BGS geological map for Dover, Kent (sheet number 290) showing the position of the Carboniferous Limestone beneath the coalfield

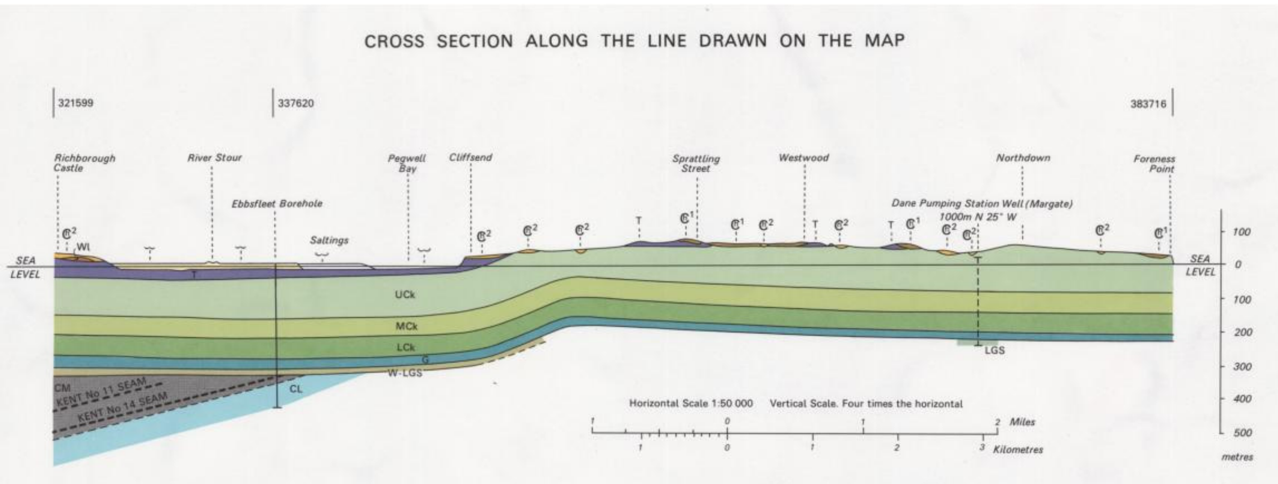


Figure 2.3: Cross section extracted from the BGS geological map for Ramsgate, Kent (sheet number 274) showing the position of the Carboniferous Limestone (coloured blue and marked "CL") beneath the coalfield

2.2.3 Berkshire Syncline

Carboniferous Limestone occurs beneath Coal Measures in the Berkshire syncline west and north of Reading, as shown on Figure 2.4. The Aston Tirrold borehole encountered just over 10 m of basal Carboniferous Limestone, in a shale facies, at 716 m below the surface. About 10 m (unbottomed) of higher velocity limestone was found in Foudry Bridge borehole farther south, but at 820 m below the surface. This indicates an area of Carboniferous Limestone between and probably west of these boreholes, which is a potential target.

SSW NNE

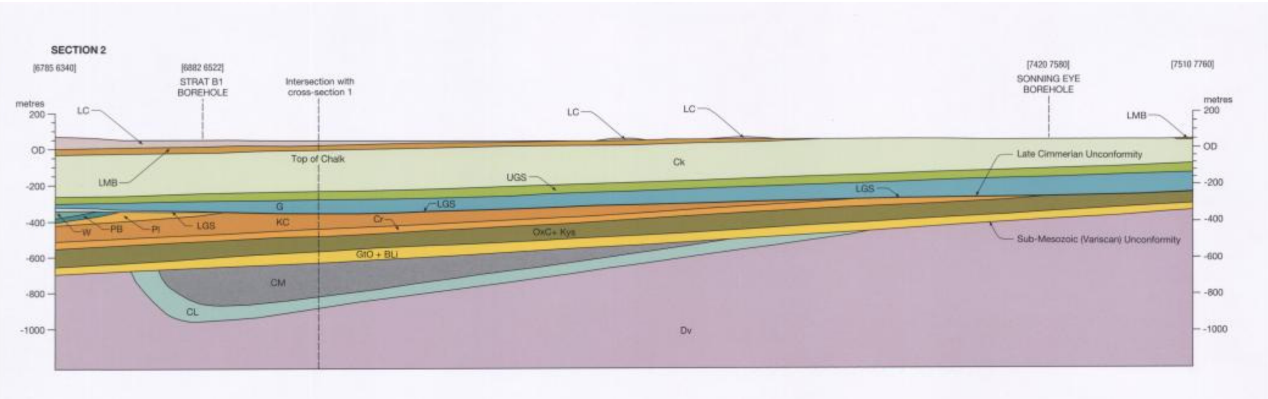


Figure 2.4: Cross-section 2 extracted from the BGS geological map for Reading, Berkshire (sheet number 268) showing the position of the Carboniferous limestone in the Berkshire syncline (marked "CL")
Horizontal scale 1:50,000, Vertical exaggeration x 2.5, Drift deposits omitted. Note: Cross-section 1 from this sheet is also reproduced as Figure 2.5.

2.2.4 East Sussex

The Carboniferous limestones, which outcrop in the Mendip Hills in Somerset, are known to extend east into the South East region although most of it is too deep for consideration for underground mining. However, to the south and east of Brightling it rises to 840 metres depth BOD (below Ordnance Datum) as it passes offshore. Hellingly 2 borehole encountered 97 m (unbottomed) of hard limestone with uniform gamma ray and high velocity between 884 and 981 m below ground level.

2.3 Potential Areas of Resource - Igneous Rocks

The term 'igneous rocks' can include a wide range of rock types, e.g. granite, basalt or andesite, and these are grouped together because they are all formed from magma (or molten rock). They can be coarse grained, e.g. granite, if the magma cooled at depth or fine grained, e.g. basalt, if they are formed from lava cooling at the surface. Variations in composition result in additional differences in lithology and associated properties.

In general terms most igneous rocks are suitable for use as aggregates because they tend to be hard and durable. Fine grained varieties can also have a high PSV in certain circumstances. Outcrops on the surface tend to be relatively small in surface area but are intensively worked for aggregates at more than 30 locations in England. A total of 21.9 million tonnes of igneous rocks were extracted in England in 2007; of this 14.7 million tonnes came from Leicestershire, where four large quarries are located (although there are also others). In addition to the above, there is a very large igneous rock quarry in Scotland from where rock is transported by ship to the Isle of Grain in Kent.

Data on physical properties of igneous rocks from surface quarries are more frequently published than for limestone because of the requirement to satisfy specifications for use in road construction. Due to the wide variety of individual rock types included in the category 'igneous rocks', there are also broad ranges of PSV, AAV and other properties. For currently active quarries the available information indicates that PSV ranges from 50 (hornfelsed andesite) to 68 (andesitic tuff), while AAV ranges from 1.2 (dacite) to 8.2 (basalt).

Igneous rocks are proven to exist in several boreholes and their presence is suggested by geophysical techniques over a wide area of Berkshire and Oxfordshire. However, it should be remembered that sills of volcanic rocks can be highly variable both in thickness and depth from surface and therefore their extent may be greater or less than that shown on the map. Furthermore, if a volcanic sill of similar thickness is more steeply dipping in one location than elsewhere it may appear to have a smaller surface area on the map whilst actually containing the same volume of rock.

Igneous rocks subcrop the Variscan unconformity in the Upwood, Warboys, possibly Bletchley boreholes and on the Islip Anticline, south of the Bicester borehole in an area close to the culmination of the London Platform (Smith 1985), as shown on Figure 2.7. They are found at three or possibly four stratigraphic levels within the subcrop sequence: intra-Westphalian (299-315 Ma), Silurian (426-444 Ma), Ordovician (444-479 Ma) and Precambrian (>542 Ma).

2.3.1 Westphalian igneous rocks

Westphalian igneous rocks occur in the Berkshire-Oxfordshire Basin (syncline) e.g. in the Burnt Hill borehole as volcanics (as shown on Figure 2.5) and in the Steeple Aston borehole as a sill or as separate leaves of probably the same sill. The sill was intruded into the Halesowen Formation near its base, where it overlies in different places Coal Measures, Devonian or Lower Palaeozoic rocks.

NW SE

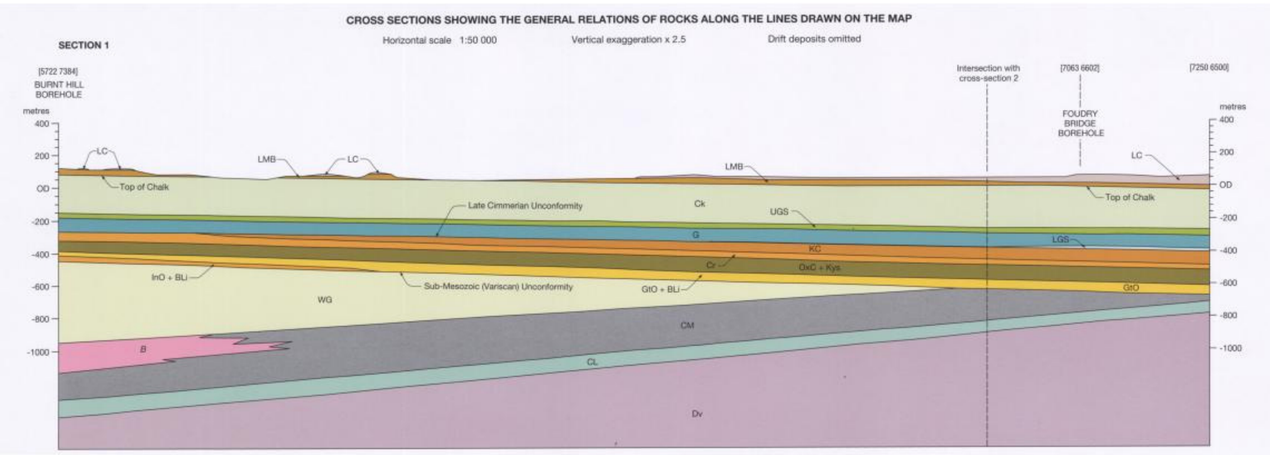


Figure 2.5: Cross-section 1 extracted from the BGS geological map for Reading, Berkshire (sheet number 268) showing the location of volcanics intersected by the Burnt Hill volcanics (coloured pink and marked "B" on the left) plus Carboniferous Limestone (marked "CL") Note: Cross-section 2 from this sheet is also reproduced as Figure 2.4.

2.3.2 Silurian volcanics

At a deeper stratigraphic level the Bicester borehole found early Silurian or Ordovician volcanics underlying Llandovery sediments (early Silurian), as shown in Figure 2.6. These rocks subcrop the Variscan unconformity beneath part of the Islip Anticline and can be mapped widely in the subsurface, to the west only, using seismic reflection data (Smith 1987). The area stretches from Bicester nearly as far westwards as their two outcrop areas in the Mendips and at Tortworth, Gloucestershire (Smith 1985). This extent is not shown in the map at Figure 2.7, because the depths have not been calculated from the sonic velocity data. The andesite volcanics in the Mendips, where they are quarried, are of Wenlock age, (428-423 Ma) and have a sonic velocity of 4572 ms^{-1} (Green & Welch 1965).

The Bicester borehole logs show a varied sequence with both low sonic velocity (soft) and high sonic velocity (harder) units. The average velocity of this sequence is rather low (3594 ms^{-1}), but this property would be expected to increase deeper in the subsurface.

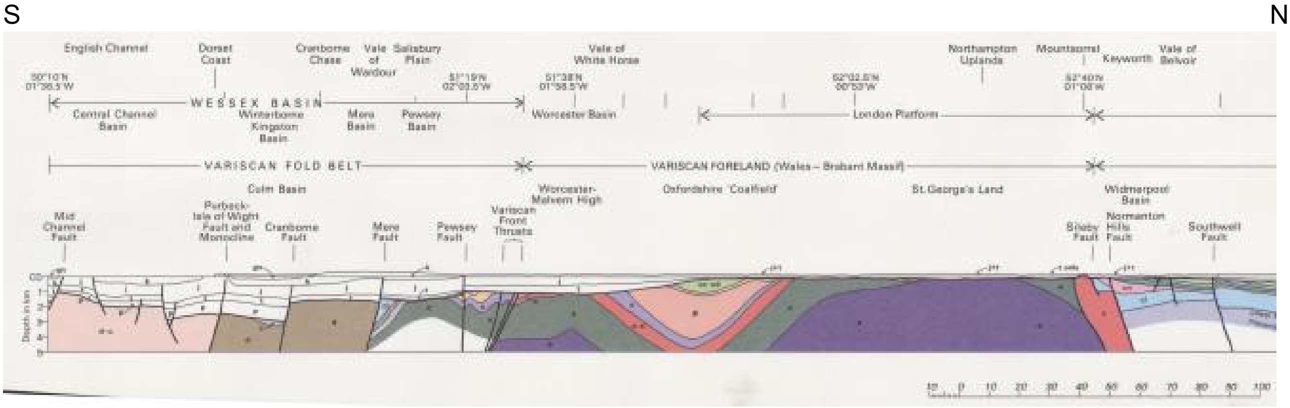


Figure 2.6: Cross-section extracted from Smith (1985) showing the location of igneous rocks in the Oxfordshire coalfield (coloured red), horizontal scale bar in kilometres

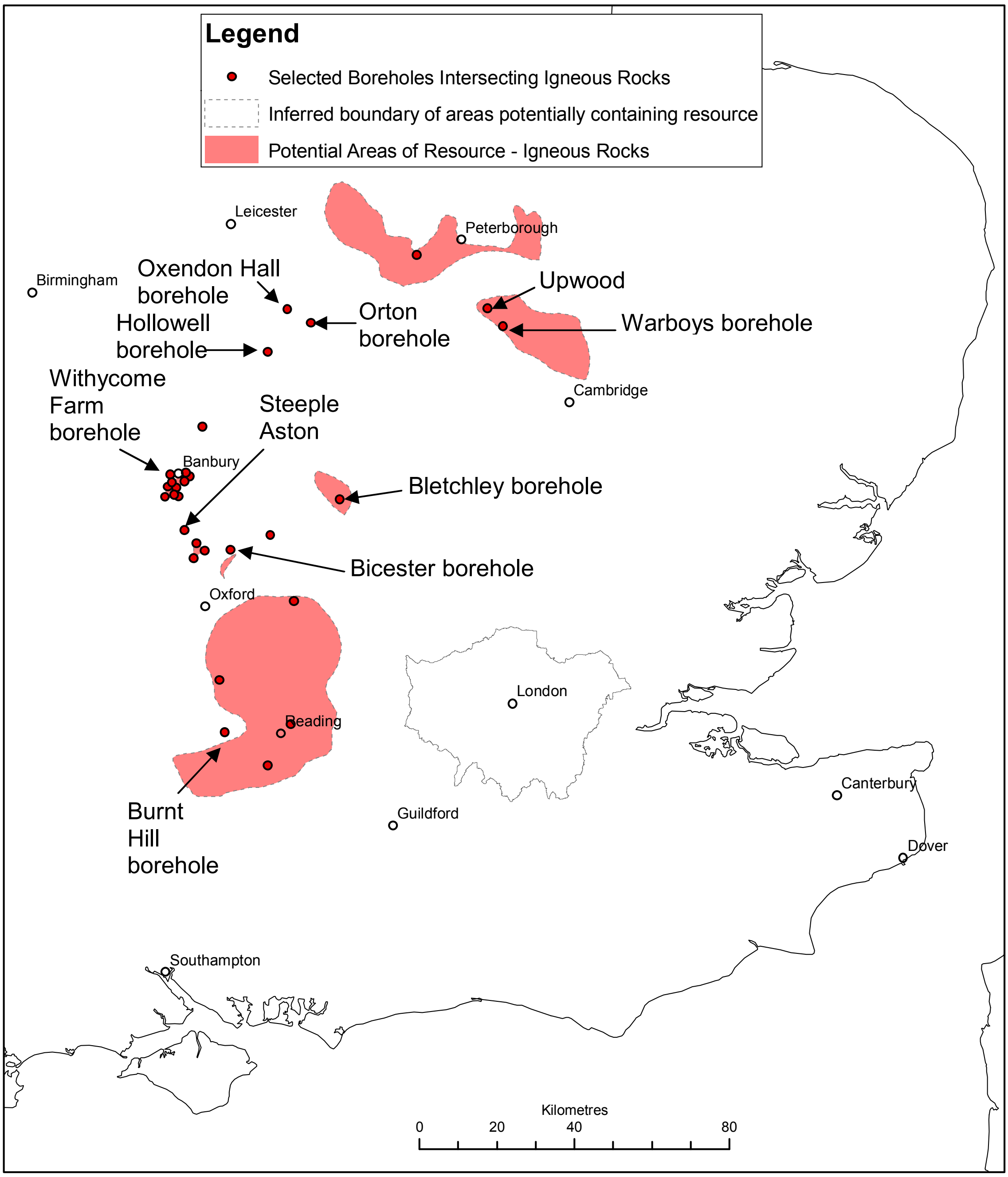


Figure 2.7: Potential areas of resource for igneous rocks

2.3.3 Ordovician

Upwood and Warboys boreholes contain basement rocks which are of probable Ordovician ages based on surrounding evidence. Upwood reached coarse agglomerate and tuffs at about 190 m below surface. Warboys borehole found porphyritic diorite which was extensively jointed with mineralisation at 170 m below surface. These boreholes are separated slightly from the Mountsorrel-type aeromagnetically-defined line of intrusions. The intrusions contain high levels of magnetite which produces positive magnetic anomalies. This line of intrusions extends from Hathern, Leicestershire through the Mountsorrel outcrop towards Peterborough.

2.3.4 Precambrian

Precambrian rocks lie unconformably beneath Lower Cambrian at outcrop (where they are quarried, e.g. Nuneaton, Charnwood) and beneath the Variscan unconformity at a couple of boreholes, near to the outcrop (Orton, Oxendon Hall) at depths from surface of 218 m and 232 m respectively. This area is close to the existing surface quarries and any mine located here may not be able to compete economically with them.

Tuffs were encountered at 336 m below the surface in Hollowell borehole and a prominent gravity low to the east of this borehole was modelled as granite rising to above 1000 m below surface (Allsop et al. 1987) but overlain by the Carboniferous Northampton Basin.

Precambrian volcanic rocks have also been drilled at a depth of 1035 m below surface in the Withycombe Farm borehole (beneath Lower Cambrian). Logs indicate a high density (2.83 g/cm^3) and sonic velocity (5620 ms^{-1}), confirmed by laboratory tests giving saturated densities (2.78-2.85 g/cm^3) and porosities of 0.6-0.9% (Poole 1978).

Bletchley Station borehole is an old record (drilled in 1887) in which subsequent re-interpretation (Davies & Pringle 1913) suggests that Lias sandstone with basement clasts was reached at terminal depth, probably lying just above the basement. The clasts, which were not kept, have been described as granite, Charnian and ‘finely crystalline quartz-felsite with green mica’. A magnetic high trending E-W lies just south of Bletchley Station borehole and may indicate igneous basement, which merges southwards into the NE extension of the Islip Anticline, where the Ordovician-Silurian volcanics are mapped.

2.4 Potential Areas of Resource - Sandstone

The examination of sandstone extraction is complicated because many formations are worked for building stone rather than aggregates and many of the building stone quarries also sell small quantities of aggregates as a ‘by-product’. Although a large number of sandstone formations have high PSV, not all of them are suitable for use as aggregates because they are frequently friable, porous (meaning they will be damaged by frost) and weak. However, more indurated sandstones, such as greywacke (also often known as ‘gritstone’) are generally stronger and as a consequence are very valuable rocks for road surfacing applications. Although published PSV range from 60 to 70, it is frequently the formations with the highest values that have the poorest AAV, i.e. around 12, which would make them unsuitable for road surfacing materials. Consequently, it is often sandstones with PSV of around 63 to 65 that typically have AAV of around 3 to 6, and these are most valuable.

Sales of sandstone in 2007 amounted to 6.9 million tonnes in England (and 3.5 million tonnes in Wales), however it is not possible to separate the high PSV sandstone from these official figures.

The South Wales quarries in the Brithdir and Hughes members and Grovesend Formation of the Warwickshire Group have some of the highest PSVs combined with appropriate AAVs. Equivalent sandstones occur in a north-south line from outcrop in Warwickshire to Oxford and Berkshire and also in Kent, as shown in Figure 2.3. However, this does not necessarily mean that these rocks in England have similar PSV or AAV to those in South Wales. It may be that they have been less deeply buried during their geological history and consequently that they are less indurated (hard). In addition, these sandstones contain saline water in Kent, potable water near to the outcrop in Warwickshire and gas in Oxfordshire.

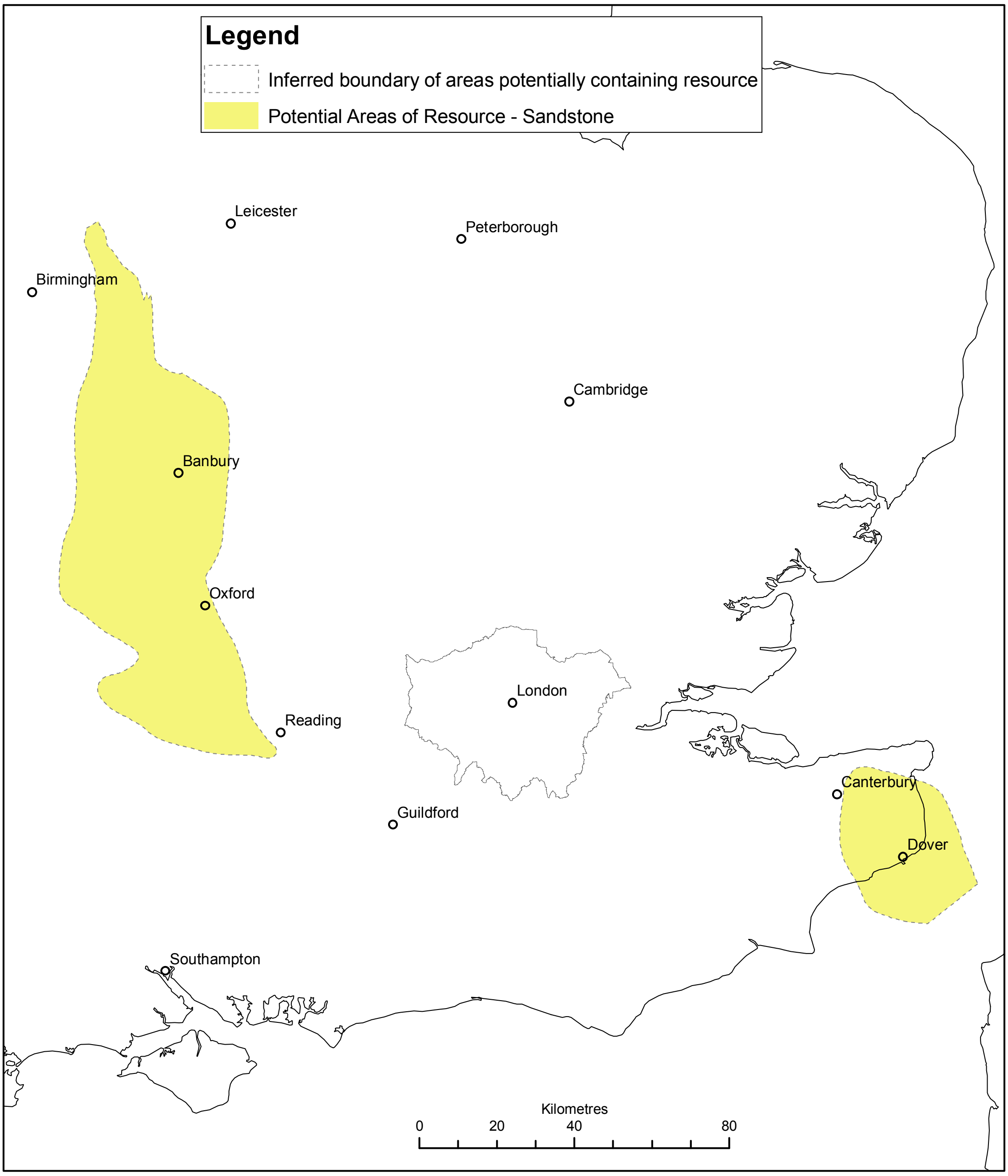


Figure 2.8: Potential areas of resource for Sandstone

2.5 Potential Areas of Resource - Jurassic Limestone

The youngest group of rocks which may have some potential for underground mining of aggregates is the Great Oolite Group (GOG, Middle Jurassic, 161-175 Ma). This group comprises two main, thick limestones (Great Oolite and Inferior Oolite) and interbedded middle shalier formations (Fuller's Earth).

Typical Jurassic-aged limestones on the surface have aggregate abrasion values (AAV) that are greater than 16, and therefore they are only suitable for use in less demanding aggregates applications. Polished stone values (PSV) for Jurassic-aged limestone are not generally recorded but are likely to be less than 40.

However, based on the sonic well interval velocity comparison between the Great Oolite Group and the Carboniferous Limestone a similar level of induration and porosity loss of GOG limestones is achieved at a depth of about 600 m. The probable line indicating changes in velocity with depth of burial is between the values for the Sherborne and Godley Bridge boreholes, as shown on Figure 2.9. Uplift from a depth similar to Godley Bridge can then be interpreted for the Detention and Wallcrouch boreholes. The two values for Detention are because the sequence is repeated by faulting. Many of the Weald Basin boreholes show uplift from earlier deeper burial, helping to make the harder limestones more accessible.

Probably the best place for investigation of Jurassic limestones is near the Mountfield-Brightling Purbeck Inlier and the nearest borehole is at Brightling, as shown on the map at Figure 2.10. Jurassic limestones at shallower depths on the London Platform to the north have not achieved the necessary burial to reach this value (e.g. Aston Tirrold).

Limestone has been mined in the Mountfield Jurassic inlier in the past but no workings are currently active (this was probably the Purbeck Limestone for building stone). Gypsum was also mined at Brightling. Nearby the GOG top lies at 708 m below surface with the base at 856 m below surface. Gas is likely to be a hazard here within the Upper Jurassic (i.e. above the GOG).

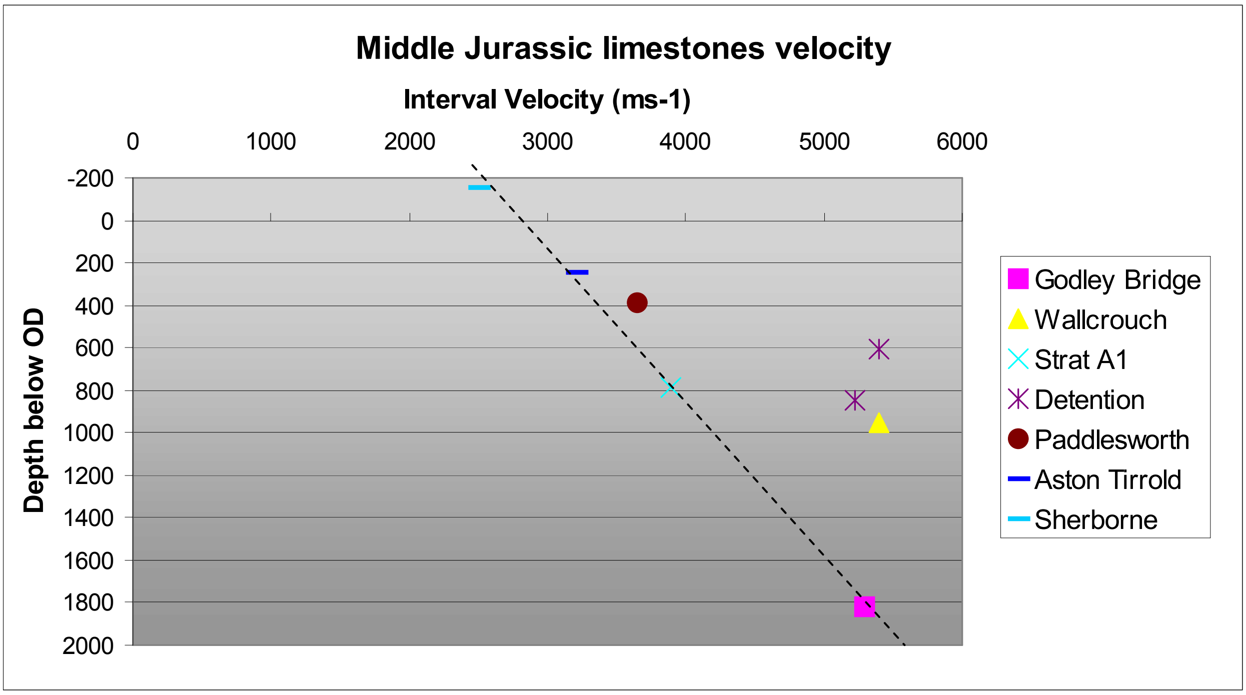


Figure 2.9: Recorded interval velocity with respect to depth for Middle Jurassic limestones.

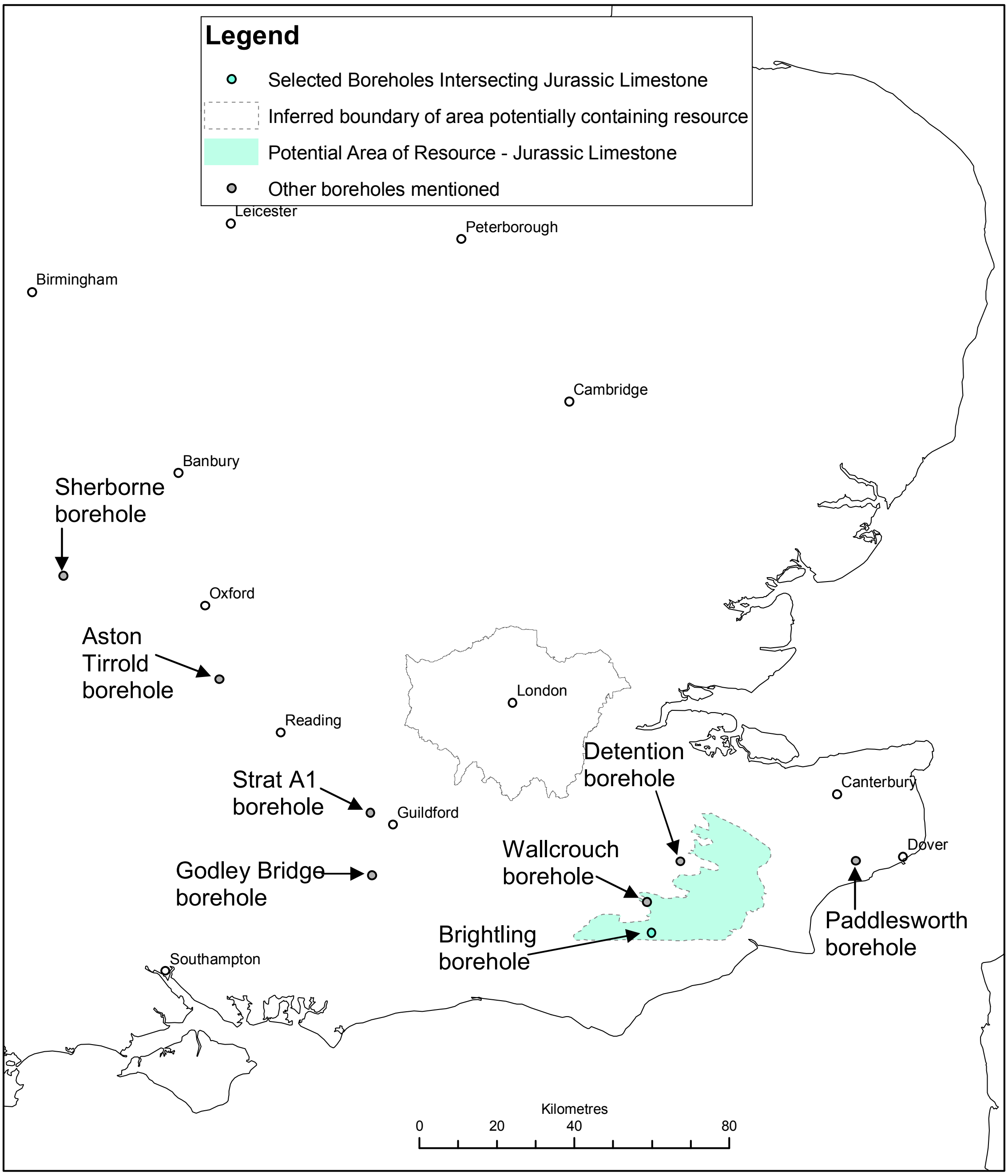


Figure 2.10: Potential area of resource for Jurassic Limestone

2.6 Coinciding or overlapping targets

There are a number of places where multiple targets exist. For example:

1. Westphalian sandstones contain igneous rocks, near Oxford, which overlie Silurian volcanics, with Precambrian volcanics deeper still.
2. Further south, near Reading, a similar situation occurs, but also with Carboniferous Limestone (which is probably thickening to the south).
3. In the Kent Coalfield sandstones are overlying Carboniferous Limestone.

In all three locations, these lithologies are interbedded with coal and consequently methane could be a problem. It is known to have migrated into the sandstones in Oxfordshire and a couple of localities in Kent had problems with methane during coal mining.

Table 2.1: Summary of key borehole information used in subsequent parts of the study.

Borehole	Region	Easting	Northing	Latitude	Longitude	Lithology	Water	Depth (m)	Thick (m)
Littlebourne	South East	619620	157570	51.2749	1.1474	LMST_C	wet	797	1.37
Kingsdown	South East	637170	149220	51.1930	1.3930	LMST_C	wet	904	14.65
Ringwould	South East	635290	148120	51.1839	1.3654	LMST_C	wet	1076	14.3
Betteshanger 2DB	South East	631980	154880	51.2459	1.3225	LMST_C	wet	798	5.3
Chslet 34DB	South East	622760	162920	51.3217	1.1956	LMST_C	wet	510	3.9
Chislet 35DB	South East	621780	159720	51.2934	1.1796	LMST_C	wet	660	1
Adisham	South East	622600	154300	51.2444	1.1880	LMST_C	wet	987	8.22
Fleet	South East	630800	160050	51.2928	1.3090	LMST_C	wet	582	15.84
Barnsole	South East	628246	156781	51.2645	1.2703	LMST_C	wet	813	22.21
Betteshanger BH	South East	632640	152930	51.2281	1.3307	LMST_C	wet	887	5.79
Betteshanger 7DB	South East	634890	152670	51.2249	1.3627	LMST_C	wet	791	3.81
Bishopsbourne	South East	619100	152910	51.2333	1.1371	LMST_C	wet	910	20.06
Chislet Park	South East	621180	163100	51.3240	1.1731	LMST_C	wet	808	319.1
Chislet 39DB	South East	621220	161760	51.3119	1.1729	LMST_C	wet	525	2.74
Chitty	South East	623120	164770	51.3382	1.2020	LMST_C	wet	344	269.8
Ebbsfleet	South East	633700	161900	51.3082	1.3517	LMST_C	wet	353	70.01
Elham	South East	618000	143800	51.1519	1.1158	LMST_C	wet	698	17.37
Harmansole	South East	614150	152890	51.2350	1.0663	LMST_C	wet	387	7.92
Little Duskin	South East	617989	149650	51.2044	1.1192	LMST_C	wet	686	16.39
Lydden Valley	South East	636730	154990	51.2449	1.3905	LMST_C	wet	597	20.72
Meggot Farm	South East	625446	141066	51.1245	1.2204	LMST_C	wet	1339	10.18
Mattice Hill	South East	633570	156910	51.2635	1.3466	LMST_C	wet	625	7.31
Oxney	South East	635220	146950	51.1734	1.3637	LMST_C	wet	1128	12.19
Paddlesworth Court	South East	619900	140410	51.1208	1.1409	LMST_C	wet	1129	11.79
Ripple	South East	634330	149980	51.2009	1.3529	LMST_C	wet	966	45.11
Rushbourne	South East	619320	163550	51.3287	1.1467	LMST_C	wet	424	312.6
Stodmarsh	South East	621110	160050	51.2966	1.1702	LMST_C	wet	654	35.66
Tollgate	South East	635581	157140	51.2647	1.3755	LMST_C	wet	509	8.91
Trapham	South East	623400	157100	51.2692	1.2012	LMST_C	wet	846	135.33
Walmestone	South East	626140	159550	51.2902	1.2419	LMST_C	wet	694	2.74
Woodnesborough	South East	629780	156480	51.2611	1.2921	LMST_C	wet	799	3.65
Bletchley	South East	486840	233770	51.9956	359.2634	GRANITE	dry	115	9
Bicester	South East	458720	220810	51.8828	358.8517	VOLC	dry	386	128
Withycombe Farm	South East	443190	240170	52.0582	358.6285	VOLC	dry	1034	29
Byfield	West Midlands	451460	252486	52.1682	358.7510	VOLC	dry	773	11
GH10	East of England	505970	287400	52.4743	359.5587	QTZT	dry	275	12
GST2	East of England	506740	296730	52.5579	359.5731	VOLC	dry	253	16
Upwood	East of England	524930	283040	52.4311	359.8361	VOLC	dry	191	23
Warboys	East of England	529032	278390	52.3883	359.8946	VOLC	dry	170	46
Steeple Aston	South East	446870	225860	51.9293	358.6802	BASA	dry	611	165
Burnt Hill	South East	457200	173800	51.4603	358.8219	BASA	dry	1049	123
Aston Tirrold	South East	455790	187220	51.5811	358.8038	BASA	dry	614	86
Strat B1	South East	468220	165220	51.3819	358.9789	DOLR	dry	746	5
Akeman Street	South East	452072	220562	51.8812	358.7551	DOLR	dry	350	31
Northbrook	South East	449945	222462	51.8985	358.7245	BASA	dry	498	19
Milton	South East	445220	234510	52.0072	358.6574	DOLR	dry	720	100
Warkworth	South East	448195	239713	52.0537	358.7014	BASA	dry	665	8
Overthorpe Rd	South East	447205	240716	52.0628	358.6871	BASA	dry	715	14
Calvert East	South East	469030	224570	51.9154	359.0022	VOLC	dry	174	1
Sonning Eye	South East	474200	175800	51.4763	359.0670	BASA	wet	593	48
Old Barn	South East	444680	236790	52.0277	358.6498	BASA	dry	779	36
Ells Farm	South East	442597	237008	52.0299	358.6195	BASA	dry	903	8
Vicarage Farm	South East	449180	218680	51.8645	358.7128	VOLC	dry	517	6
Oxendon Hall	East Midlands	473430	282750	52.4378	359.0787	VOLC	dry	232	15
Orton	East Midlands	479420	279160	52.4047	359.1660	VOLC	dry	218	22
Hollies Barn	South East	441866	234346	52.0060	358.6085	VOLC	dry	934	61
Hollowell	East Midlands	468300	271800	52.3400	359.0011	VOLC	dry	336	24
Cottage Homes	East Midlands	456960	295620	52.5554	358.8387	VOLC	dry	192	3
Crouch Farm	South East	443610	238192	52.0404	358.6344	BASA	dry	879	4
Brickhouse Farm	South East	444170	234975	52.0115	358.6421	BASA	dry	776	15
Bodicote	South East	446866	238434	52.0423	358.6819	DOLR	dry	738	17
Brightling	South East	567250	121820	50.9715	0.3808	LMST_J	dry	708	148

LMST_C = Carboniferous Limestone; VOLC = Volcanics; QTZT = Quartzite; BASA = Basalt; LMST_J = Jurassic Limestone

3 Valuation Approach

3.1 Reference Year of 2007

The study took 2007 as the reference year for which all valuations were undertaken, primarily motivated by the easier availability of data with which to populate all cost models, land values by region and development use and other ancillary data. Where costs were only available for years alternate to 2007, these were adjusted for the effect of inflation using ONS cost and price indices.

An auxiliary consequence of utilising 2007 as the reference year for all comparisons is that it avoids extreme values of cost variables prevalent during 2008, close to the last economic peak and also avoids 2009 values arising as a result of the recessionary economy prevalent at the time of writing. As a result, analyses and cost comparisons presented herein are broadly assumed to apply to a post-recession economy experiencing moderate growth.

3.2 Value of discount rate adopted

The discount rate assumed in all valuation calculations was taken at 10%. DCAD(10%) thus denotes the discounted cost of aggregate delivered when the discount rate is set at 10%.

The value adopted for the discount rate used in computation of the DCAD was established through consideration of the rate of return that may be expected of the next-best-alternative investment available for the capital used to create the project. For the reference year of 2007 used for establishing costs, valuations, etc. the Bank of England base rate fluctuated between 5% and 6%. The value of 10% adopted thus represents the adoption of a relatively modest risk premium of between 5% and 4% for commercial investors interested in aggregates production and investment in other similar bulk commodities.

3.3 Underground aggregates mine models

Valuation models for underground aggregates operations were established that accommodate:

- a range of production intensities (from 1,500 tonnes per day, 0.375 million tonnes per annum (MTPA); to 14,000 tonnes per day 3.5 MTPA),
- two distinct mining techniques (room-and-pillar and long hole open stoping),
- two distinct primary access methods (shaft and adit) that could be considered either wet or dry,
- variable shaft or adit depth,
- varying distances from the target market area (defined as the distance to the M25 orbital around London),
- specific site conditions apparent at the BGS borehole locations where data on potential aggregate horizon lithology was available, and;
- varying rates of transport cost depending on proximity to the rail network and scale of production intensity.

The underground aggregates mine valuation models developed are sufficiently detailed that as well as embodying the basic production and distribution costs, they also assimilate environmental, health and safety costs, measure the energy and carbon implications and consider after-use and concurrent use aspects quantitatively. Consequently they permit the first part of Project Objective A to be attained.

3.4 Mining Methods

The need to eliminate the opportunity for subsidence to occur above the underground aggregates mining operation essentially restricts the choice of mining method to those that are termed pillar supported, such as the room-and-pillar method (Figure 3.1). It is possible that either artificially supported or unsupported mining methods may be adopted (see Figure 3.2), but this introduces some probability that subsidence will occur. For the purposes of this, essentially economic, study, pillar supported methods are assumed.

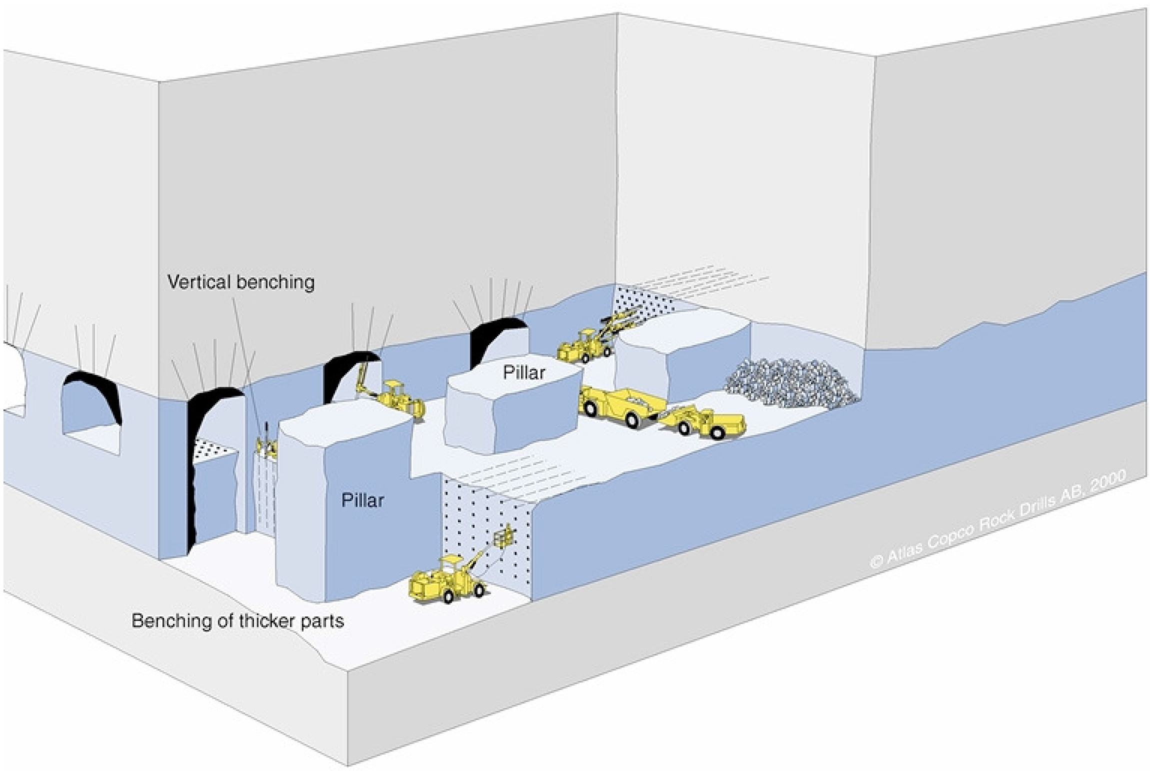


Figure 3.1: Schematic of the room-and-pillar mining operations (Hustrulid, 2001)

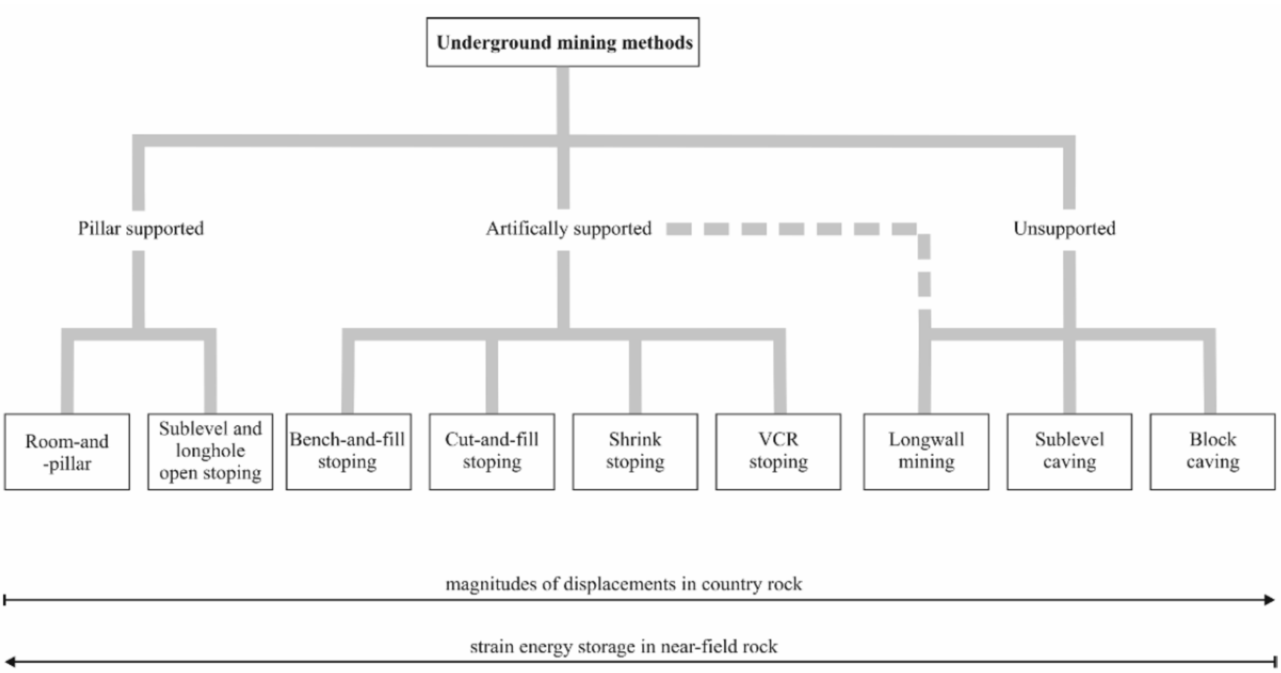


Figure 3.2: Spectrum of mining methods spanning pillar supported at the LHS to unsupported on the RHS. (after Brady and Brown, 2006)

The mining methods that are thus considered for the underground mining of aggregates are:

- Room-and-pillar
- Long hole open stoping

The room-and-pillar mining method is suited to stone occurrences that are broadly flat lying with uniform thickness and large lateral extent. The long hole open stoping method is considered as this provides an option when stone occurrences are not extensive laterally, but are thick. Both mining methods can be considered when the stone occurrence is massive, although in these instances, the room and pillar method may be preferred as the extraction ratio (the volume of stone mined / total stone volume) is generally higher for the room-and-pillar method.

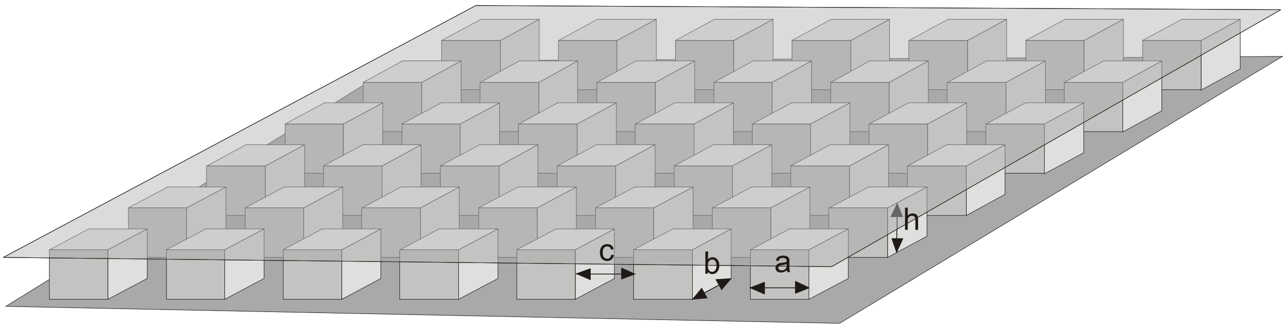


Figure 3.3: Schematic of the room-and-pillar mining layout showing, a: pillar width, b: pillar depth, c: room width and h: pillar height.

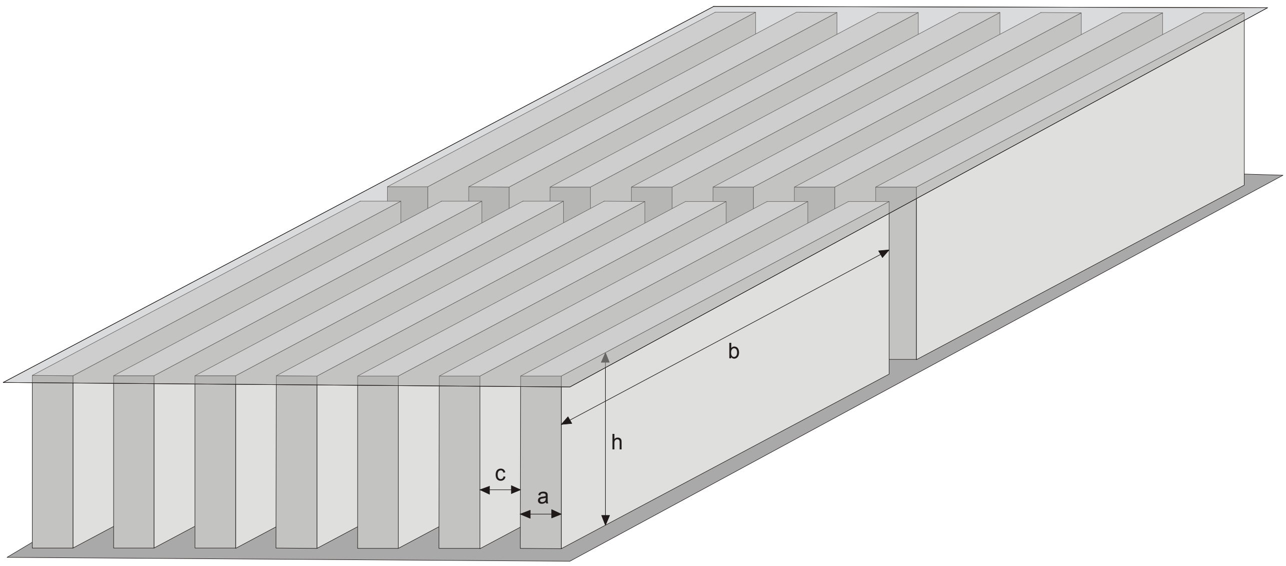


Figure 3.4: Schematic of the long hole open stoping mining layout showing, a: pillar width, b: pillar depth, c: stope (room) width and h: stope (pillar) height.

3.4.1 Pillar Strength and Factor of Safety

The vertical stress acting above the stoping area is assumed to be due to overburden weight only:

$$\sigma_z = \gamma z$$

where γ is the unit weight of rock, taken to be 27 kN/m^3 in all cases and z is the depth of the stope below ground level. When the stone is mined, the overburden load is concentrated over the area of the top surface of each pillar. The corresponding average stress acting in each pillar is determined using the tributary area theory (see, for example, Brady and Brown, 2006, p376 and Figure 3.5):

$$\sigma_p = \frac{1}{1-e}\sigma_z$$

where e is the (area based) extraction ratio. The extraction ratio expresses the proportion of stone that is actually mined of the total stone available to be mined. With reference to Figure 3.3 to Figure 3.5, the extraction ratio is defined:

$$e = \frac{(a+c)(b+c)-ab}{(a+c)(b+c)}$$

For a constant and full height mining layout, the area based extraction ratio will be equal to the volume based extraction ratio, and for constant stone density will be equal to the mass recovery of the stone resource.

Pillar strength is determined using the empirical expression proposed by Lundur and Palalnis, 1997 which was developed from 178 cases of hard rock mining practice using the room-and-pillar mining method and is widely used (see, for example Maybee, 2000). The equation describing this pillar strength criterion is:

$$S = K\sigma_c\left(C_1 + C_2\kappa\right)$$

where K is a parameter taken to relate the uniaxial compressive strength (UCS) of intact rock σ_c to the mass strength of the rock mass in which the pillar is developed. K, C_1 and C_2 are empirical constants established through regression analyses from the case study data. κ is determined using the following:

$$\kappa = \tan\left(\cos^{-1}\left(\frac{1-C_3}{1+C_3}\right)\right)$$

$$C_3 = 0.46\log_{10}\left(\frac{a}{h}+0.75\right)^{\frac{1.4}{a/h}}$$

and is an empirical factor that enhances the pillar strength if it is squat and thus the pillar materials experience confinement due to this geometry. Lunder and Palalnis determined $K = 0.44$, $C_1 = 0.68$ and $C_2 = 0.52$.

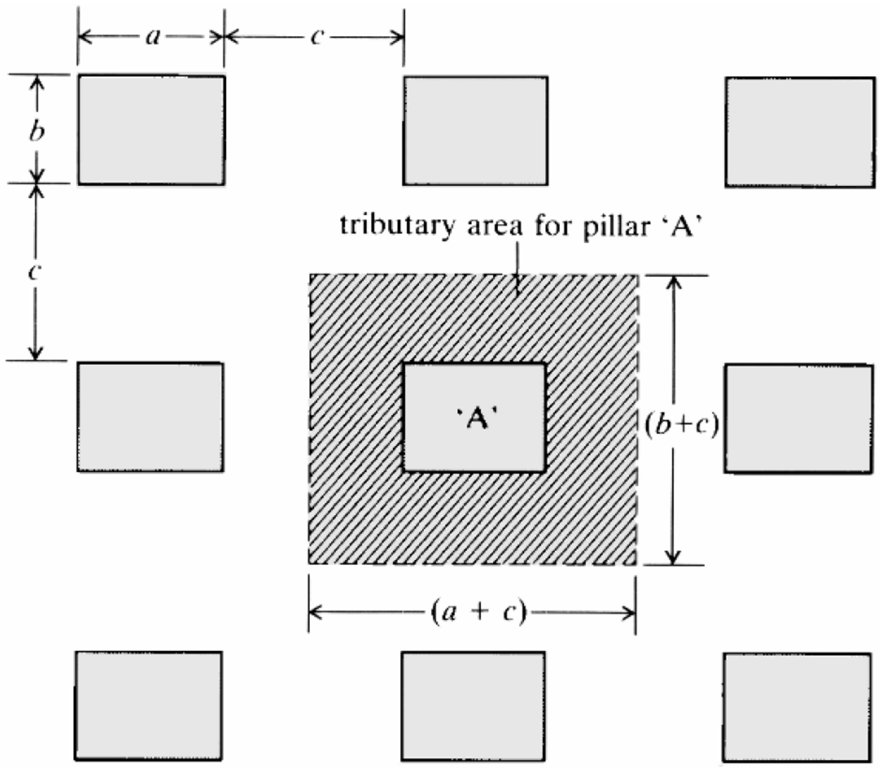


Figure 3.5: Illustration of tributary area of a rock pillar (after Brady and Brown, 2006)

The factor of safety, F, for the pillar establishes how many times greater than the pillar strength is relative to the average stress induced in the pillar due to mining:

$$F = \frac{S}{\sigma_p}.$$

In their studies of mining operations, Lunder and Palalnis (1997) determined that when the factor of safety was set to 1.4, their pillar strength criterion was able to effectively discriminate between pillars that were stable and pillars that had failed. In the current case, the afteruse of the underground workings is an important consideration and could be, for example, a civil or civic use that would require a factor of safety greater than that which would apply for mining operations. In similar, but more recent studies (Esterhuizen *et al*., 2007) found that adopting a factor of 1.8 in their criterion led to the correct discrimination of pillar that had failed (e.g. the hourglassing shown in Figure 3.6) and those that had not, over a case study database comprising thousands of pillars. As a result, for the purposes of this study, a factor of safety of 1.8 is adopted in the room-and-pillar layout design, with the inferred consequence that it is unlikely that the resulting layout would eliminate use of the underground space created by mining from a particular end use, on the grounds that the pillars were unsafe.

The analysis for pillar strength set out herein applies for both the room-and-pillar and the long hole open stoping mining layouts. Given that the pillar strength criterion contains the uniaxial compressive strength parameter for the rock in which the pillars are developed, this is the manner in which the pillar strength formula is rendered specific to particular aggregate geologies. The following table provides guidance on basic intact rock material properties for rock types including those that may be expected to feature in UK underground aggregates mines.

Table 3.1: Strength Properties of Rocks (after Waltham, 2009)

Rock type	density dry t/m^3	porosity %	dry UCS range MPa	dry UCS mean MPa	UCS saturated MPa	modulus of elasticity GPa	tensile strength MPa	shear strength MPa	friction angle °
Granite	2.7	1	50-350	200		75	15	35	55
Basalt	2.9	2	100-350	250		90	15	40	50
Greywacke	2.6	3	100-200	180	160	60	15	30	45
Sandstone-Carboniferous	2.2	12	40-100	70	50	30	5	15	45
Sandstone-Triassic	1.9	25	5-40	20	10	4	1	4	40
Limestone-Carboniferous	2.6	3	50-150	100	90	60	10	30	35
Limestone-Jurassic	2.3	15	15-70	25	15	15	2	5	35
Chalk	1.8	30	5-30	15	5	6	0.3	3	25
Mudstone-Carboniferous	2.3	10	10-50	40	20	10	1		30
Shale-Carboniferous	2.3	15	5-30	20	5	2	0.5		25
Clay-Cretaceous	1.8	30	1-4	2		0.2	0.2	0.7	20
Coal	1.4	10	2-100	30		10	2		
Gypsum	2.2	5	20-30	25		20	1		30
Salt	2.1	5	5-20	12		5			
Hornfels	2.7	1	200-350	250		80			40
Marble	2.6	1	60-200	100		60	10	32	35
Gneiss	2.7	1	50-200	150		45	10	30	30
Schist	2.7	3	20-100	60		20	2		25
Slate	2.7	1	20-250	90		30	10		25

UCS = Uniaxial Compressive Strength

From Table 3.1, the following values of uniaxial compressive strength were adopted for application to aggregate geologies identified in the review of the BGS borehole and geophysical database.

Basalt	180	MPa
Dolerite, Granite	120	MPa
Carboniferous limestone, Quartzite, Volcanics	80	MPa
Jurassic limestone	40	MPa

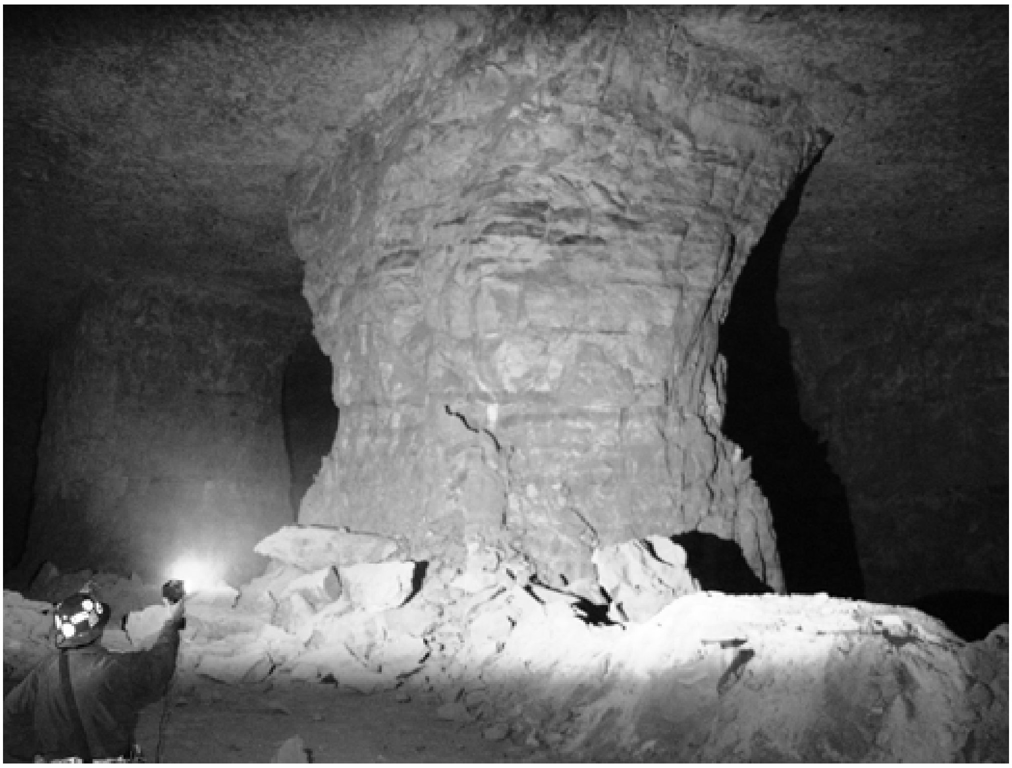


Figure 3.6: Photograph of a pillar with hourglass profile, a classical indicator of an overloaded pillar (from Esterhuizen et al., 2007).

3.4.2 Stoping Layout

For the room-and-pillar mine models, the pillar height has been maintained at 8 metres in all cases, a dimension arising from the reach limitations of the drilling jumbo specified in the production cost models for this mining method. The stope width for 2,500 to 14,000 tonnes per day operations was set at 14 metres, and 12 metres, a dimension arising from the need for more frequent passing of trucks with the higher production rates. In the analysis of each underground aggregates prospect considered, the pillar width of square sectioned pillars was then adjusted such that the pillar factor of safety is 1.8. Thus the key pillar design variable is the dimension of the pillar width, for the given room widths. Scoping calculations that provide an indication of room-and-pillar layouts for various depths below surface, a range of rock types that could be encountered and a factor of safety of 1.8 are presented in Table 3.2.

The supporting pillars for the long hole stoping method are deeper and are higher than those for the room-and-pillar method. Pillar (stope) height is set at 20 metres for the lower production rates of 1,500 and 2,500 tonnes per day and at 25 metres for the higher production rates of 5,000 and 14,000 tonnes per day (exemplar calculations for 25 m height only are presented in Table 3.3). The pillar depth, b is taken as 50m, and thus the key pillar design variable is again the pillar width a, which also effectively describes the distance between adjacent stopes. For each rock type considered, and for increasing depths, the minimum pillar width resulting in a factor of safety, F=1.8, is determined. The results of this analysis are presented in Table 3.3.

These stope dimensions ensure that the method can use large scale stone moving and loading equipment, matched to those specified in the mining method specifications. The stope roof in each case is likely to be stabilised using reinforcement techniques such as cable or rock bolting and possibly shotcrete. In the case of the long hole open stoping method, the stope (pillar) height has been maintained at 25 metres for most production rates as this represents a practical depth of drill holes used in the long hole open stoping method. Higher stopes are possible, but these normally require the development of additional sub-levels which are not considered here.

It is evident from Table 3.2 and Table 3.3, that the room-and-pillar mine layout will generally be the preferred method because the extraction ratios for this method are higher than for the long hole open stoping method, other things being equal. The only situation where the long hole method would be opted for, over the room-and-pillar method, is when the lateral extent of the resource is very low, or the stone is steeply dipping. Figure 3.7 shows a plot of the degree of pillar stressing, relative to the undisturbed stress, against the area based extraction ratio. The plot demonstrates that the rate of change of pillar overstressing increases rapidly after the extraction ratio exceeds approximately 0.75; if the design value of the extraction ratio was 0.8, then a marginal increase in extraction ratio due to, say, poor blasting practice, could lead to a significant increase in pillar overstressing. It is for this reason, that in Table 3.2, for cases of relatively low depth, the pillar width has been set at a value higher than that required to yield a factor of safety of 1.8, but is a width that establishes an extraction ratio less than or equal to 0.75. Under this circumstance, poor blasting practice producing a localised higher than design value of extraction ratio, will lead to only a moderate increase in overstressing of the pillar.

It is also clear from examination of Table 3.2 and Table 3.3 that as the depth of workings increases, extraction ratios become very low and the pillar dimensions become large, especially for workings created in weaker geological materials. Economic aggregates production in these situations is thus unlikely. The calculations also show that for very shallow underground aggregates mines mining plans with smaller pillar dimensions and thus higher extraction ratios can readily be designed. However, it is worthy to note that although a factor of safety against pillar failure of 1.8 means that subsidence effects are significantly diminished, issues associated with blast induced ground vibrations may still lead to difficulties in securing planning permission.

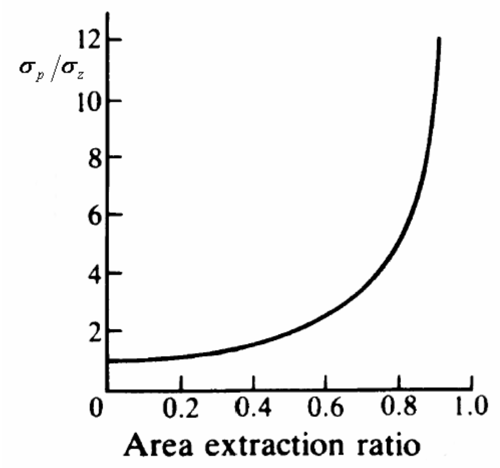


Figure 3.7: Plot of pillar overstressing against extraction ratio (after Brady & Brown, 2006)

3.4.3 Mineable Resource

Generally when a resource tonnage is defined, this will be the figure considered in the absence of the mining layout adopted. When the practicalities of ensuring stable creation of underground space are considered, the extraction ratio defines that tonnage which practically can be extracted from the in-situ resource. For constant stone density and uniform thickness, the extraction ratio will also reflect the proportion of the plan area of a prospect that can actually be mined. For a given total extracted tonnage under these circumstances, the extraction ratio then determines on the area of land undermined by the stopes and thus also the area of land assumed procured in the mine valuation models.

3.4.4 Summary

The pillar stability and stoping layout calculation procedures discussed in this section are fairly crude but befit the economic nature of the study being undertaken. Detailed design would be required in consideration of these factors in feasibility and engineering studies for actual underground aggregate mining developments. This may require recovery of samples of the exploited horizon, determination of the degree and disposition of natural fracturing, and determination of the magnitudes and directions of stress at the mining horizon, to name just three important aspects. The calculation sequence set out here enables estimation of the extraction ratio which is important in establishing the land area required for a specific prospect and confirmation of a credible stable pillar geometry. Hence the calculation sequence was integrated into the economic mine valuation model.

Table 3.2: Room-and-pillar design layouts for varying rock types and increasing depth F>=1.8

Aggregates with UCS = 40 MPa					Jurassic Limestone								
Depth	a	b	c	h	a/h	**e**	σ_z	σ_P	σ_c	Cpav	K	S	FOS
(m)	(m)	(m)	(m)	(m)			(MPa)	(MPa)	(MPa)			(MPa)	
100	14	14	14	8	1.8	**0.75**	2.7	10.8	40.0	0.220	1.203	23.0	2.1
150	16.5	16.5	14	8	2.1	**0.71**	4.1	13.8	40.0	0.267	1.411	24.9	1.8
200	20.5	20.5	14	8	2.6	**0.65**	5.4	15.3	40.0	0.322	1.673	27.3	1.8
300	30.58	30.58	14	8	3.8	**0.53**	8.1	17.2	40.0	0.395	2.078	31.0	1.8
400	45.08	45.08	14	8	5.6	**0.42**	10.8	18.6	40.0	0.436	2.341	33.4	1.8
500	70.75	70.75	14	8	8.8	**0.30**	13.5	19.4	40.0	0.459	2.502	34.9	1.8
600	134.7	134.7	14	8	16.8	**0.18**	16.2	19.7	40.0	0.468	2.575	35.5	1.8

Aggregates with UCS = 80 MPa					Carboniferous Limestone								
Depth	a	b	c	h	a/h	**e**	σ_z	σ_P	σ_c	Cpav	K	S	FOS
(m)	(m)	(m)	(m)	(m)			(MPa)	(MPa)	(MPa)			(MPa)	
100	14	14	14	8	1.8	**0.75**	2.7	10.8	80.0	0.220	1.203	46.0	4.3
150	14	14	14	8	1.8	**0.75**	4.1	16.2	80.0	0.220	1.203	46.0	2.8
200	14	14	14	8	1.8	**0.75**	5.4	21.6	80.0	0.220	1.203	46.0	2.1
300	16.52	16.52	14	8	2.1	**0.71**	8.1	27.7	80.0	0.267	1.412	49.8	1.8
400	20.66	20.66	14	8	2.6	**0.64**	10.8	30.4	80.0	0.324	1.682	54.7	1.8
500	25.25	25.25	14	8	3.2	**0.59**	13.5	32.6	80.0	0.365	1.900	58.7	1.8
600	30.58	30.58	14	8	3.8	**0.53**	16.2	34.4	80.0	0.395	2.078	62.0	1.8
700	37	37	14	8	4.6	**0.47**	18.9	35.9	80.0	0.418	2.223	64.6	1.8
800	45.08	45.08	14	8	5.6	**0.42**	21.6	37.1	80.0	0.436	2.341	66.8	1.8
900	55.74	55.74	14	8	7.0	**0.36**	24.3	38.0	80.0	0.449	2.433	68.5	1.8
1000	70.75	70.75	14	8	8.8	**0.30**	27.0	38.7	80.0	0.459	2.502	69.7	1.8

Aggregates with UCS = 120 MPa					Granite, Andesite								
Depth	a	b	c	h	a/h	**e**	σ_z	σ_P	σ_c	Cpav	K	S	FOS
(m)	(m)	(m)	(m)	(m)			(MPa)	(MPa)	(MPa)			(MPa)	
100	14	14	14	8	1.8	**0.75**	2.7	10.8	120.0	0.220	1.203	68.9	6.4
150	14	14	14	8	1.8	**0.75**	4.1	16.2	120.0	0.220	1.203	68.9	4.3
200	14	14	14	8	1.8	**0.75**	5.4	21.6	120.0	0.220	1.203	68.9	3.2
300	14	14	14	8	1.8	**0.75**	8.1	32.4	120.0	0.220	1.203	68.9	2.1
400	15.19	15.19	14	8	1.9	**0.73**	10.8	39.9	120.0	0.244	1.307	71.8	1.8
500	17.86	17.86	14	8	2.2	**0.69**	13.5	43.0	120.0	0.288	1.509	77.3	1.8
600	20.66	20.66	14	8	2.6	**0.64**	16.2	45.6	120.0	0.324	1.682	82.1	1.8
700	23.65	23.65	14	8	3.0	**0.61**	18.9	47.9	120.0	0.352	1.832	86.2	1.8
800	26.93	26.93	14	8	3.4	**0.57**	21.6	49.9	120.0	0.376	1.963	89.8	1.8
900	30.58	30.58	14	8	3.8	**0.53**	24.3	51.6	120.0	0.395	2.078	93.0	1.8
1000	34.71	34.71	14	8	4.3	**0.49**	27.0	53.2	120.0	0.411	2.178	95.7	1.8

Aggregates with UCS = 180 MPa					Basalt, Greywacke								
Depth	a	b	c	h	a/h	**e**	σ_z	σ_P	σ_c	Cpav	K	S	FOS
(m)	(m)	(m)	(m)	(m)			(MPa)	(MPa)	(MPa)			(MPa)	
100	14	14	14	8	1.8	**0.75**	2.7	10.8	180.0	0.220	1.203	103.4	9.6
150	14	14	14	8	1.8	**0.75**	4.1	16.2	180.0	0.220	1.203	103.4	6.4
200	14	14	14	8	1.8	**0.75**	5.4	21.6	180.0	0.220	1.203	103.4	4.8
300	14	14	14	8	1.8	**0.75**	8.1	32.4	180.0	0.220	1.203	103.4	3.2
400	14	14	14	8	1.8	**0.75**	10.8	43.2	180.0	0.220	1.203	103.4	2.4
500	14	14	14	8	1.8	**0.75**	13.5	54.0	180.0	0.220	1.203	103.4	1.9
600	15.19	15.19	14	8	1.9	**0.73**	16.2	59.8	180.0	0.244	1.307	107.7	1.8
700	16.96	16.96	14	8	2.1	**0.70**	18.9	63.0	180.0	0.275	1.445	113.4	1.8
800	18.77	18.77	14	8	2.3	**0.67**	21.6	65.8	180.0	0.301	1.569	118.5	1.8
900	20.66	20.66	14	8	2.6	**0.64**	24.3	68.4	180.0	0.324	1.682	123.1	1.8
1000	22.63	22.63	14	8	2.8	**0.62**	27.0	70.7	180.0	0.343	1.784	127.3	1.8

Note: a, b, c and h are defined in Figure 3.3 to Figure 3.5, remaining parameters are defined in 3.4.1

Table 3.3: Long hole open stope design layouts for varying rock types and increasing depth F>=1.8

Aggregates with UCS = 40 MPa					Jurassic Limestone								
Depth (m)	a (m)	b (m)	c (m)	h (m)	a/h	**e**	σ_z (MPa)	σ_P (MPa)	σ_c (MPa)	Cpav	K	S (MPa)	FOS
100	13.48	50	14	25	0.5	**0.62**	2.7	7.0	40.0	0.002	0.078	12.7	1.8
150	21.31	50	14	25	0.9	**0.53**	4.1	8.6	40.0	0.034	0.382	15.5	1.8
200	29.13	50	14	25	1.2	**0.47**	5.4	10.2	40.0	0.101	0.705	18.4	1.8
300	48.14	50	14	25	1.9	**0.39**	8.1	13.4	40.0	0.248	1.324	24.1	1.8
400	78.57	50	14	25	3.1	**0.34**	10.8	16.3	40.0	0.364	1.896	29.3	1.8
500	157.4	50	14	25	6.3	**0.28**	13.5	18.8	40.0	0.443	2.393	33.9	1.8
600	0	0	0	0	0.0	**0.00**	0.0	0.0	0.0	0.000	0.000	0.0	0.0

Aggregates with UCS = 80 MPa					Carboniferous Limestone								
Depth (m)	a (m)	b (m)	c (m)	h (m)	a/h	**e**	σ_z (MPa)	σ_P (MPa)	σ_c (MPa)	Cpav	K	S (MPa)	FOS
100	10	50	14	25	0.4	**0.67**	2.7	8.3	80.0	0.000	0.010	24.1	2.9
150	10	50	14	25	0.4	**0.67**	4.1	12.4	80.0	0.000	0.010	24.1	1.9
200	13.48	50	14	25	0.5	**0.62**	5.4	14.1	80.0	0.002	0.078	25.4	1.8
300	21.31	50	14	25	0.9	**0.53**	8.1	17.2	80.0	0.034	0.382	30.9	1.8
400	29.13	50	14	25	1.2	**0.47**	10.8	20.5	80.0	0.101	0.705	36.8	1.8
500	37.85	50	14	25	1.5	**0.43**	13.5	23.7	80.0	0.176	1.020	42.6	1.8
600	48.14	50	14	25	1.9	**0.39**	16.2	26.8	80.0	0.248	1.324	48.2	1.8
700	61.05	50	14	25	2.4	**0.36**	18.9	29.7	80.0	0.311	1.617	53.5	1.8
800	78.57	50	14	25	3.1	**0.34**	21.6	32.6	80.0	0.364	1.896	58.6	1.8
900	105.4	50	14	25	4.2	**0.31**	24.3	35.2	80.0	0.408	2.157	63.4	1.8
1000	157.4	50	14	25	6.3	**0.28**	27.0	37.6	80.0	0.443	2.393	67.7	1.8

Aggregates with UCS = 120 MPa					Granite, Andesite								
Depth (m)	a (m)	b (m)	c (m)	h (m)	a/h	**e**	σ_z (MPa)	σ_P (MPa)	σ_c (MPa)	Cpav	K	S (MPa)	FOS
100	10	50	14	25	0.4	**0.67**	2.7	8.3	120.0	0.000	0.010	36.2	4.4
150	10	50	14	25	0.4	**0.67**	4.1	12.4	120.0	0.000	0.010	36.2	2.9
200	10	50	14	25	0.4	**0.67**	5.4	16.6	120.0	0.000	0.010	36.2	2.2
300	13.48	50	14	25	0.5	**0.62**	8.1	21.1	120.0	0.002	0.078	38.0	1.8
400	18.78	50	14	25	0.8	**0.55**	10.8	24.1	120.0	0.018	0.274	43.4	1.8
500	23.85	50	14	25	1.0	**0.51**	13.5	27.4	120.0	0.054	0.490	49.4	1.8
600	29.13	50	14	25	1.2	**0.47**	16.2	30.7	120.0	0.101	0.705	55.3	1.8
700	34.8	50	14	25	1.4	**0.44**	18.9	33.9	120.0	0.151	0.916	61.1	1.8
800	41.07	50	14	25	1.6	**0.42**	21.6	37.1	120.0	0.201	1.123	66.7	1.8
900	48.14	50	14	25	1.9	**0.39**	24.3	40.1	120.0	0.248	1.324	72.3	1.8
1000	56.37	50	14	25	2.3	**0.37**	27.0	43.1	120.0	0.291	1.521	77.7	1.8

Aggregates with UCS = 180 MPa					Basalt, Greywacke								
Depth (m)	a (m)	b (m)	c (m)	h (m)	a/h	**e**	σ_z (MPa)	σ_P (MPa)	σ_c (MPa)	Cpav	K	S (MPa)	FOS
100	10	50	14	25	0.4	**0.67**	2.7	8.3	180.0	0.000	0.010	54.3	6.5
150	10	50	14	25	0.4	**0.67**	4.1	12.4	180.0	0.000	0.010	54.3	4.4
200	10	50	14	25	0.4	**0.67**	5.4	16.6	180.0	0.000	0.010	54.3	3.3
300	10	50	14	25	0.4	**0.67**	8.1	24.9	180.0	0.000	0.010	54.3	2.2
400	11.52	50	14	25	0.5	**0.65**	10.8	30.6	180.0	0.000	0.031	55.1	1.8
500	15.32	50	14	25	0.6	**0.59**	13.5	33.1	180.0	0.005	0.138	59.5	1.8
600	18.78	50	14	25	0.8	**0.55**	16.2	36.2	180.0	0.018	0.274	65.2	1.8
700	22.15	50	14	25	0.9	**0.52**	18.9	39.5	180.0	0.040	0.418	71.1	1.8
800	25.58	50	14	25	1.0	**0.50**	21.6	42.8	180.0	0.069	0.562	77.0	1.8
900	29.13	50	14	25	1.2	**0.47**	24.3	46.1	180.0	0.101	0.705	82.9	1.8
1000	32.85	50	14	25	1.3	**0.45**	27.0	49.3	180.0	0.134	0.846	88.7	1.8

Notes: a, b, c and h are defined in Figure 3.3 to Figure 3.5, remaining parameters are defined in 3.4.1. No viable solution is obtained for this method at a depth of 600 m in Jurassic Limestone.

3.5 Shaft development

Shaft development cost can be the most significant component of underground mine capital expenditure (>50% of total capital expenditure for a 14,000 tonnes per day underground mine with shaft depth ~600m), and thus the model used to estimate these cost is set out in full within this section. The method reported in the SME Mining Engineering handbook (O'Hara *et al.*, 1992) is a frequently adopted estimation method for shaft development costs. However it is fully empirically-based and also somewhat dated. Consequently effort was allocated to upgrading the O'Hara model so that at least the variable cost component, that is the depth dependent cost component, could be estimated with improved confidence. The estimation model was rendered suitable for the current purposes by:

- allowing recent input costs for labour, explosives, grout, etc to be used,
- rendering the model sensitive to varying shaft geology, and;
- rendering the model it sensitive to sinking through wet measures, by means of varying the advance rates, allowing for probe hole drilling and modelling grout consumption explicitly.

In the shaft development cost estimation model set out, fixed cost components, such as head gear and shaft equipment, were estimated using O'Hara's methods. These costs were estimated originally in 1992 US$, converted to 1992 £ using currency exchange rates applicable to 1992, and then these were corrected to 2007 terms by use of cost indices for construction projects sourced from Langdon (2006). Input costs for the depth dependent cost models applied for 2007 directly.

The total capital cost of developing a shaft, C_{shaft}, is:

$$C_{shaft} = C_{sink} + C_{hf} + C_{equip}$$

where:

- C_{sink} is the cost of sinking operations,
- C_{hf} is the cost of the head frame of the shaft and its winder,
- C_{equip} is the cost of equipping the shaft with skips, mancages, ropes, guides, pipework, etc.

The cost of sinking operations comprises:

$$C_{sink} = C_{grout} + C_{drill} + C_{expl.} + C_{labour} + C_{lining} + C_{facilities}$$

where

- C_{grout} is the cost of grout used to create an impervious seal around the shaft to prevent the ingress of water (where necessary),
- C_{drill} is the cost of drilling required,
- C_{expl} is the cost of explosives,
- C_{labour} is the cost of labour used to develop the shaft,
- C_{lining} is the cost of procuring and emplacing concrete to create a permanent internal lining,
- $C_{facilities}$ is the fixed cost of surface facilities such as a concrete plant.

C_{hf} and C_{equip} were estimated using the O'Hara method and corrected to 2007 terms using exchange rates and inflationary indices. C_{sink} was the variable element of cost estimated using the improved method.

In the unmodified O'Hara *et al.*, 1992 formulation for the total capital cost of developing a shaft is:

$$C_{shaft} = C_{sink} + C_{hf} + C_{equip}$$

as before but C_{sink} simply comprises:

$$C_{sink} = C_f + C_u$$

where C_f is a fixed cost and C_u is a unit cost £/m.

The estimation methods for each of the terms in the above equations are set out in full in Appendix D and a sample set of estimation calculations is provided for the modified and unmodified methods, for a dry shaft case. The sample calculations demonstrate that the modifications are fully consistent with the unmodified form. When the modified form is used in estimation of shaft development costs of wet shaft, a cost increase of approximately 50% results, which is also broadly consistent with expectations.

3.6 Adit development

Decline development costs are closely related to tunnelling or drifting costs. Sinking at an angle increases sinking costs. Therefore, a 30% increase in costs is assumed (Wetherelt, 2009; Coggan, 2009; Foster, 2009) and is added to the obtained tunnelling costs. Working under wet conditions requires some form of ground stabilisation. The increased drilling and grouting cost are assumed be comparable to the shaft sinking model. Therefore the costs of a grouted decline are assumed to be 38% more than under conventional conditions. A 25 m^2 cross section area would, under normal circumstances, be sufficient to fit all required infrastructure and allow ventilation of the underground workings. Initial tunnelling costs are estimated at £5,000 per metre using Spon's Civil engineering and Highway Works Price Book (Langdon, 2007). Including the extra costs, the costs for a conventional sunk decline/adit are £6,500 per metre and £8,790 per metre for a grouted decline.

3.7 Summary of other capital and operating costs for the aggregates production models

The aggregates mining models only include the actual costs of mining of rock and therefore only include costs for pre-stripping, drilling, loading, hauling and primary crushing. All costs related to processing of raw material into a saleable product are captured in the processing cost model. Capital costs for equipment, buildings and plant are included in both as appropriate. The operating costs comprise maintenance, labour, fuel, power consumption and additional consumables such as explosives. Capital costs related to procurement of land, planning and permitting are not included in these cost models, but are considered in the valuation model separately as are costs for environmental mitigation measures, decommissioning and aftercare, and the installation of a railhead (if applicable). The capital costs for the quarry models, underground models and processing plant models are given in Table 3.4, Table 3.5 and Table 3.6 respectively. The respective operating costs are presented in Table 3.7 to Table 3.9.

Full details of the specification and costing exercises leading to these summary cost tables is presented in Appendix D and the specifications and cost models themselves are presented in Appendices E to H.

Table 3.4: Summary of quarry total capital costs. (£)

Quarry Capital Cost				
Stripping depth (m)	Production rate (tonnes/day)			
	1,500	2,500	5,000	14,000
0.0	6,107,036	9,295,371	20,127,457	22,635,338
1.5	8,451,662	13,291,324	23,599,126	26,154,872
3.0	8,952,479	14,295,276	24,001,988	26,605,598

Table 3.5: Summary of total capital costs for underground mine models (£)

Underground Capital Cost						
Mining Options			Production rate (tonnes/day)			
			1,500	2,500	5,000	14,000
R&P	Shaft	wet	25,249,792	35,225,245	48,893,965	69,188,899
		dry	22,151,939	32,164,908	45,673,292	65,912,381
	Decline	wet	36,032,448	43,909,037	56,671,845	57,925,868
		dry	30,929,595	38,743,700	50,346,172	52,644,350
LH	Shaft	wet	34,038,519	57,200,363	84,249,831	113,205,359
		dry	30,940,664	54,140,028	81,029,161	109,560,639
	Decline	wet	39,861,424	56,318,177	77,930,383	92,580,965
		dry	34,758,573	51,152,843	72,645,969	87,188,254

Table 3.6: Summary of processing capital cost (£)

Processing Plant Capital Cost				
Plant design	Production rate (tonnes/day)			
	1,500	2,500	5,000	14,000
Limestone plant	21,427,979	21,991,986	36,403,585	50,735,080
Granite plant	24,495,636	25,059,642	40,339,223	61,569,428

Table 3.7: Summary of quarry operating costs (£/tonne)

Quarry Unit Operational Cost				
Stripping depth (m)	Production rate (tonnes/day)			
	1,500	2,500	5,000	14,000
0.0	2.06	2.21	2.22	1.00
1.5	2.60	2.79	2.44	1.11
3.0	2.69	2.95	2.55	1.13

Table 3.8: Summary of underground aggregates mining operating costs (£/tonne)

Underground Unit Operational Cost						
Mining Options			Production rate (tonnes/day)			
			1,500	2,500	5,000	14,000
R&P	Shaft	wet	6.40	5.69	4.46	2.45
		dry	6.30	5.60	4.38	2.40
	Decline	wet	7.36	6.29	4.64	2.30
		dry	7.25	6.21	4.56	2.26
LH	Shaft	wet	12.26	11.48	8.71	4.03
		dry	12.13	11.39	8.63	3.98
	Decline	wet	10.84	10.83	7.89	3.60
		dry	10.74	10.75	7.81	3.56

Table 3.9: Summary of processing plant operating costs (£/tonne)

Processing Plant Unit Operating Cost				
Plant design	Production rate (tonnes/day)			
	1,500	2,500	5,000	14,000
Limestone plant	2.20	1.49	1.10	0.61
Granite plant	3.07	2.01	1.47	0.97

3.8 Aggregate distribution cost model

Aggregates, once mined, have to be hauled to the customer. In this study two modes of transport are considered: transport by road and transport by rail. The choice of transport modality is dependent on the type of product extracted (in general high quality material is more often transported by road as transport costs are less critical), the distance to the market and the availability of supporting infrastructure. High quality material may also come by sea, e.g. from Scotland and Northern Ireland, but quality igneous rock is also moved in bulk from Leicestershire to the EE Region and Greater London by rail.

In this study a cost model has been constructed based on a combination of three transport modalities. In the following sections the fundamentals of each mode are discussed and are combined into a model describing the average cost price per tonne of aggregate delivered.

3.8.1 Haulage truck cost model

The use of trucks is currently common practice in the aggregates industry. Traditionally, rigid vehicles have been the preferred choice for tipper operators, but in recent years, articulated vehicles with tipper semi-trailers have been introduced in the aggregates sector.

Research by the Department of Transport (Coyle, 2007) proved that articulated trucks have important advantages in efficiency compared to rigid body tipper trucks. Most of these advantages relate to the higher payload of articulated trucks. The main trucks used are 8-wheel, 4-axle rigid body tippers with a gross vehicle weight (gvw) of 32 tonnes and 6 axle articulated trucks with 44 tonnes gvw. With payloads over 17 tonnes articulated trucks are more fuel and cost efficient (Coyle, 2007). Fuel efficiency curves for these two types of trucks (as well as a 26 tonne gvw truck, not considered in this study) are presented in Figure *3.8*.

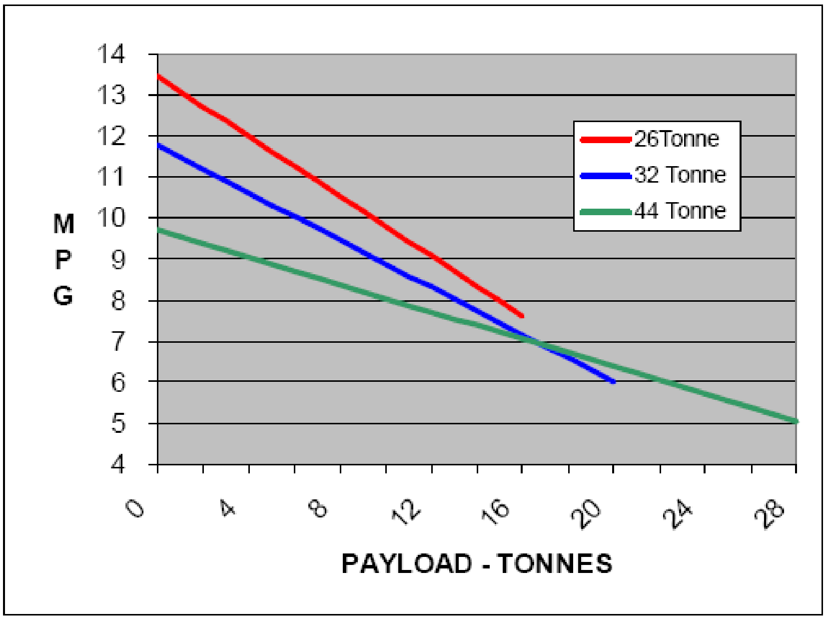


Figure 3.8: Payload in relation to fuel consumption. MPG = miles per gallon (Coyle, 2007)

Haulage of aggregates in this study is assumed to be done by contractors. In order to establish a cost model with included hauling costs, an estimate of the operator costs has been made. In the model capital and operational costs are considered separately.

3.8.2 Truck capital costs

The average purchase price of the considered equipment was determined after consultation with truck manufacturers Scania and Fruehauf (Brimfield, 2009, O'Hara, 2009) and from statistical data supplied by the Freight Transport Association (Freight Transport Association, 2009). The salvage value of the equipment at the end of its economic life is assumed to be 15 percent of the initial purchase price. Annuitised capital costs are calculated over the "consumed" value of the equipment using a 10% discount rate. Although this might vary considerably depending on trip length, the annual mileage is considered equal for each vehicle to prevent bias in comparison of both types of trucks. Truck life depends upon annual mileage and the age of equipment. On average, trucks are replaced when they reach 450,000 miles or are 6.5 years old. Truck life has been assumed to be equal for both types of trucks.

3.8.3 Truck operating costs

Operational costs have been informed by data published by the Freight Transport Association (Freight Transport Association, 2008), the Department of Transport (Coyle, 2007) and with input from Post–Kogeko, a Dutch company who provided a cost per mile for operating a haulage tractor unit and who supplied labour rates for drivers applicable in the UK.

The main operating expenditures of an aggregates haulage truck are the driver, diesel fuel and maintenance costs. Tax, insurance and tyre costs are of less importance, but are still relevant. Tax costs are retrieved from www.directgov.co.uk.

3.8.4 Truck unit costs

The sum of the annuitised capital and operational costs defines the total costs of running a truck. For both types of trucks this cost is given in a cost per mile. As haulage is assumed to be contractor operated, unit costs included in the model must cover the contractors profit as well. A profit margin of 5% is assumed as a working average. On the basis of minimum cost, contractors would operate articulated trucks only. However, in practice, contractors use a mixture of rigid bodied and articulated trucks. Rigid bodied trucks have lower capital costs, are reportedly more stable during tipping and have more traction on off-road running surfaces.

The model assimilates cost information for both types of trucks operated. The average price for both types of truck has been compared with quotes from the industry to establish a reliable estimation of the unit haulage cost.

3.8.5 Truck load factors

Although the cost of running a truck is readily estimated, including the opportunistic haulage trading for return loads into a model is not easily done. The location of a quarry or mine relative to its prime market can make a difference, as can the availability of return loads, and these affect the haul rates charged by haulage contractors. Haulage costs can thus differ for each producing site and each customer.

Trucks dominate short hauls. In particular 8x4 rigid trucks are utilised to deliver loads up to 25 miles. Articulated trucks are primarily used for longer runs which may be as long as 100 miles one way, and are thus relevant to the valuation models considered in this research. Rigid trucks are assumed to be paid for the round trip, returning empty, which is represented in the model as a load factor of 50%. Articulated trucks running distances 50 miles and longer are assumed to be paid only for the single trip and thus return with a load. This is reflected in a load factor of 100%. In practice hauling contractors are guaranteed a minimum daily pay, irrespective of transit distances. This can involve a minimum number of short hauls, or a long haul at an equivalent daily rate. Intermediate haul distances served with an articulated truck require a premium paid on top of the mile rate to cover for unpaid loading and unloading time. In the model this has been achieved by using a load factor of 75%.

3.8.6 Rail

Aggregate haulage by train is common practice on long haul distances, although in Kent rail is known to be used to haul over distances as short as 19 miles. This could be due to the unusual factor of movement from Thames Estuary marine wharves to concrete and asphalt depots in the London area. If rail infrastructure is available rail transport is attractive but in general it is used to serve distant markets, e.g. to serve a depot close to / in the market from which final distribution takes place by road. Getting extensive and reliable data proved to be difficult, but the available data allow the generalisation that aggregates can be trucked 30 miles, transported by rail 100 miles and moved by ship 1,000 miles at the same rate. Anecdotal, but unconfirmed evidence suggest that aggregate can be shipped from the South West region of England to the South East area for £5.60 / tonne.

Rail transport has a cost advantage but requires the availability of rail infrastructure at both the supplier's side, and the customer's side of the operation. Rail transport is particularly suitable for hauling of large volumes of aggregates. An operation considering the use of rail transport requires a railhead with sidings assumed of 500 metres in length and loading facilities. This is only likely to fit large operations without a constrained surface footprint. The capital investment for a railhead is included in evaluation of aggregates prospects where a connection to existing infrastructure can be made within two miles (Table 3.10). The trains are assumed to be contractor operated and are only represented in the model as a unit cost.

Table 3.10: Railhead Capital Cost. (£)

Production Rate	1,500	2,500	5,000	14,000
Loading facilities. Railhead	700,000 249,279	850,000 249,279	900,000 249,279	1,000,000 249,279
Total:	949,279	1,099,279	1,149,279	1,249,279

3.8.7 Modal share of aggregate distributed

To calculate the average delivery cost of aggregate from a producing unit, an assessment of the haulage distance and its share in the distribution of aggregate production is made.

Aggregates prospect specific haul costs in this study are calculated based on the proximity of rail infrastructure. If connecting to existing rail line is possible within two miles from the proposed site, 50% of the total production is assumed to be hauled by rail. The remaining production is shifted by means of trucks. The local market, which is assumed to be 20% of the total production, is served by 8x4 rigid trucks and the remaining volume is transported by articulated trucks. Where no railhead is available it is assumed that the split over articulated and rigid trucks is equally spread.

Under these conditions, the haulage model used in this research is shown in Figure 3.9.

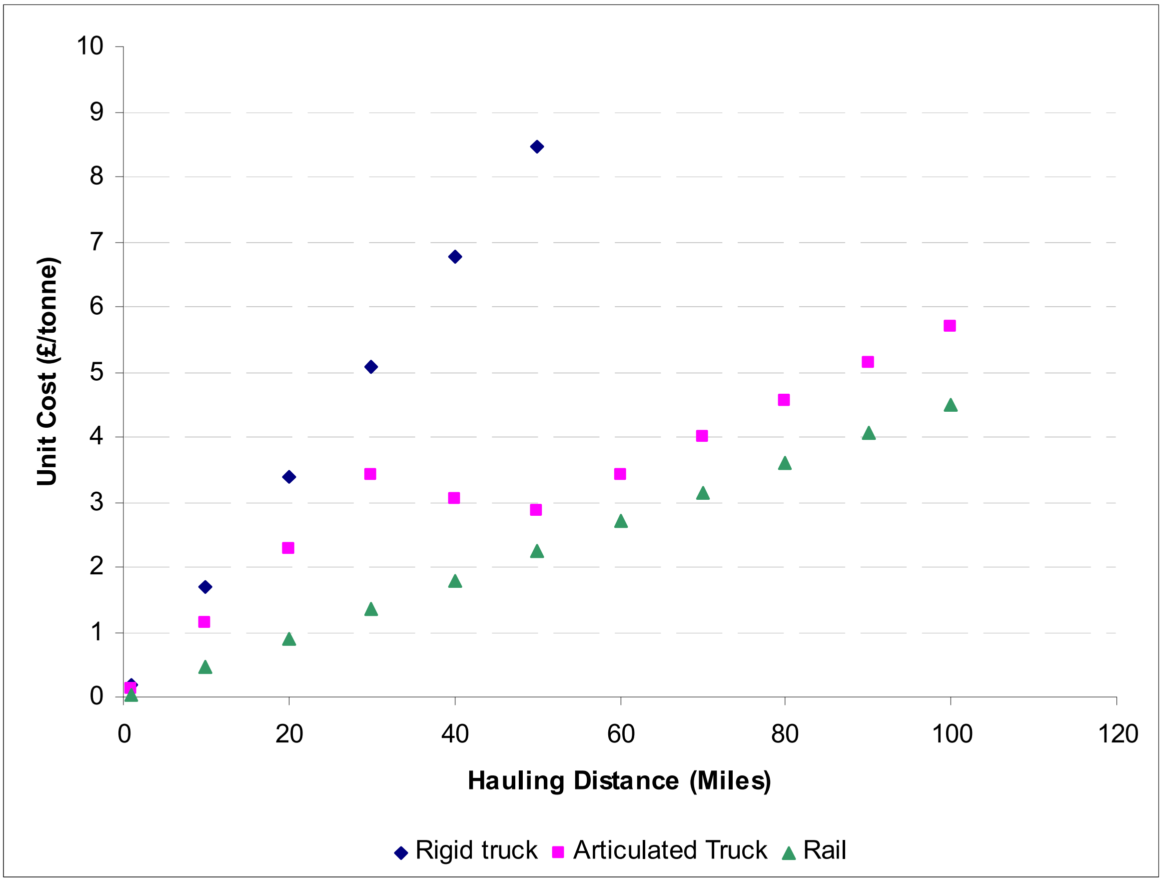


Figure 3.9: Unit haulage cost for each transport modality

3.9 Discounted cost of aggregate delivered

A 'whole systems' valuation approach was adopted that aimed to identify all costs relevant to the decision of whether or not to exploit aggregates using underground mining techniques. Once the relevant costs had been brought together, discounting methods were used to establish the discounted cost of aggregate delivered (DCAD) from underground aggregates operations.

The discounted cost of aggregate delivered is the average price per tonne of aggregate delivered to a client in the target market area from an aggregates operation that returns a zero net present value, when all relevant costs of the project are considered.

The methodology used to establish DCAD(10%) values for underground mines is illustrated in detail in Figure 3.10. For the mine type and production rate considered, all costs established from the tasks in the research programme are brought forward into the data area of the worksheet. Specifically:

- Decomissioning and aftercare costs are brought forward from the research results set out in Appendix A.
- Environmental compliance costs are brought forward from the research results set out in Appendix A.

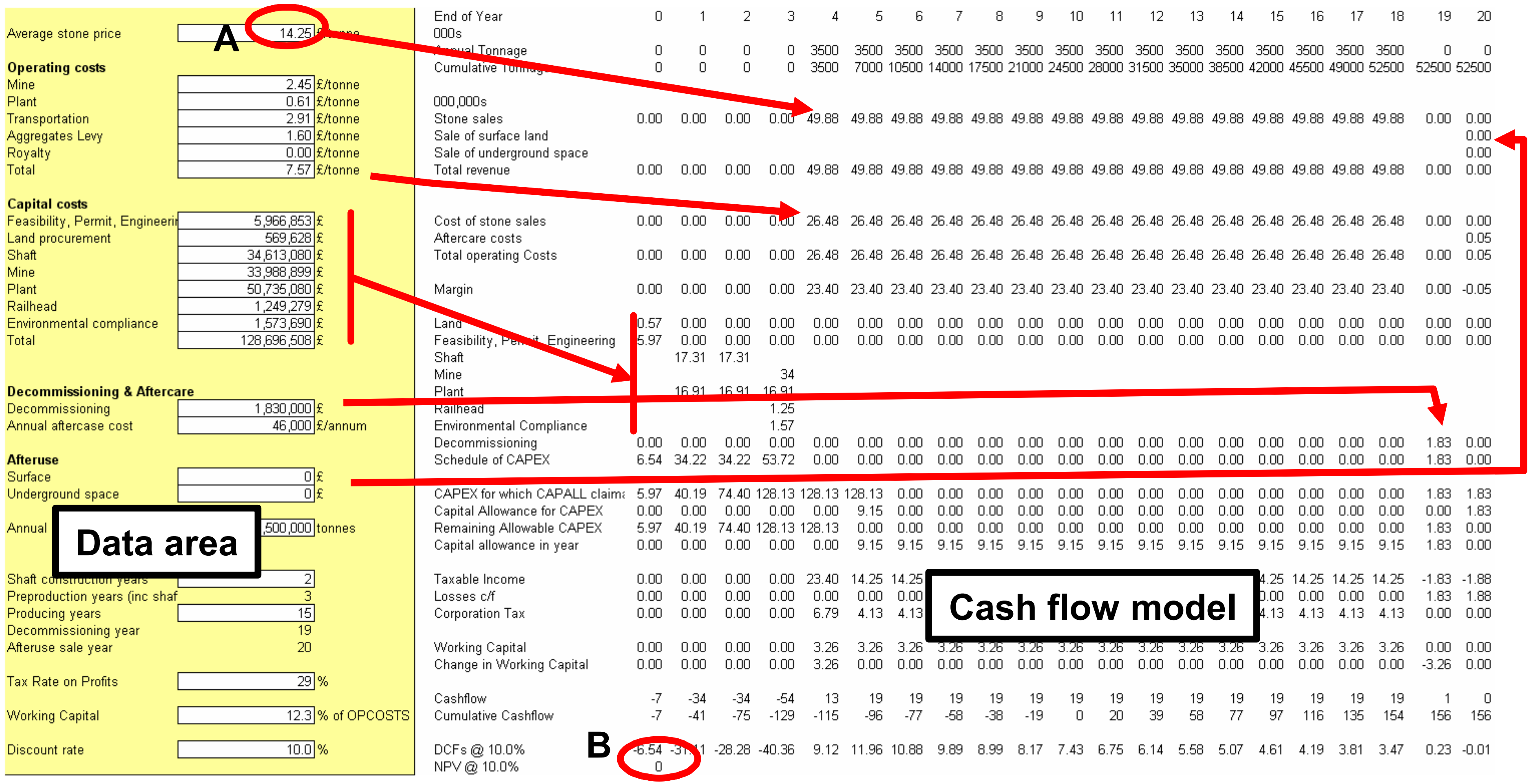
- Health and Safety compliance costs are brought forward from the research results set out in Appendix A.
- Underground after use capital credit arising from sale of underground space are brought forward from the research results set out in Appendices B and C.
- Land procurement costs are brought forward from the research results explained in detail in Appendix C.
- Surface after use capital credit arising from sale of remediated land are brought forward from the research results set out in Appendix C.
- Mine capital costs (excluding primary access, i.e. shaft/adit development costs) are brought forward from the research results with methodology explained in Appendix D and presented in details in Appendices E, F and H.
- Primary access capital costs (that are sensitive to the depth of the aggregate intersection) are also brought forward from the research results explained in detail in Appendix D.
- Aggregate processing costs are brought forward from the research results with methodology explained in detail in Appendix D and presented in details in Appendix G.
- Railhead capital cost (if applicable) and aggregate transportation costs are brought forward from the research results set out in Appendix D.

Land procurement capital costs consider the acquisition cost of all land that will be undermined by the underground aggregates mines including that portion required to accommodate the surface facilities of the underground mine. This will depend on the mine extraction ratio and hence the depth of the mining operation and in turn, the supporting pillar dimensions. The extraction ratio was established through pillar stability calculations following the sequence set out in 3.4.

Capital costs were scheduled as follows:

- Land acquisition costs and costs associated with engineering design, securing planning permission and other permits, etc. were all assumed to have been incurred at the start of the project (the end of year 0).
- The total capital cost of creating primary access to the subsurface (i.e. Shafts / Adit) were proportionally allocated over the shaft / adit development time computed, with the first allocation incurred by the end of year 1 of the project.
- Remaining mine development costs, as well as railhead (if applicable) and environmental compliance costs were allocated to the year following completion of the primary access development.
- The total capital costs of construction of the aggregate processing facilities were time-proportionally allocated over the primary access and mine development period.
- Decommissioning costs were allocated to the year after aggregate production ceased.
- Capital credits for the sale of remediated land and the underground space created were allocated to the year after the mining operation was decommissioned.

Aftercare costs were assumed to apply in the year in which the land and underground space was marketed, ready for sale by the end of the second year following the termination of aggregates production.



Average stone price	14.25	£/tonne
Operating costs		
Mine	2.45	£/tonne
Plant	0.61	£/tonne
Transportation	2.91	£/tonne
Aggregates Levy	1.60	£/tonne
Royalty	0.00	£/tonne
Total	7.57	£/tonne
Capital costs		
Feasibility, Permit, Engineeri	5,966,853	£
Land procurement	569,628	£
Shaft	34,613,080	£
Mine	33,988,899	£
Plant	50,735,080	£
Railhead	1,249,279	£
Environmental compliance	1,573,690	£
Total	128,696,508	£
Decommissioning & Aftercare		
Decommissioning	1,830,000	£
Annual aftercase cost	46,000	£/annum
Afteruse		
Surface	0	£
Underground space	0	£
Annual [illegible]	[illegible]500,000	tonnes
Shaft construction years	2	
Preproduction years (inc shaf	3	
Producing years	15	
Decommissioning year	19	
Afteruse sale year	20	
Tax Rate on Profits	29	%
Working Capital	12.3	% of OPCOSTS
Discount rate	10.0	%

End of Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
000s																					
Annual Tonnage	0	0	0	0	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	0	0
Cumulative Tonnage	0	0	0	0	3500	7000	10500	14000	17500	21000	24500	28000	31500	35000	38500	42000	45500	49000	52500	52500	52500
000,000s																					
Stone sales	0.00	0.00	0.00	0.00	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	0.00	0.00
Sale of surface land																					0.00
Sale of underground space																					0.00
Total revenue	0.00	0.00	0.00	0.00	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	49.88	0.00	0.00
Cost of stone sales	0.00	0.00	0.00	0.00	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	0.00	0.00
Aftercare costs																					0.05
Total operating Costs	0.00	0.00	0.00	0.00	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	26.48	0.00	0.05
Margin	0.00	0.00	0.00	0.00	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	0.00	-0.05
Land	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feasibility, Permit, Engineering	5.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shaft		17.31	17.31																		
Mine				34																	
Plant		16.91	16.91	16.91																	
Railhead				1.25																	
Environmental Compliance				1.57																	
Decommissioning	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00
Schedule of CAPEX	6.54	34.22	34.22	53.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00
CAPEX for which CAPALL claim	5.97	40.19	74.40	128.13	128.13	128.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	1.83
Capital Allowance for CAPEX	0.00	0.00	0.00	0.00	0.00	9.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83
Remaining Allowable CAPEX	5.97	40.19	74.40	128.13	128.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00
Capital allowance in year	0.00	0.00	0.00	0.00	0.00	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	1.83	0.00
Taxable Income	0.00	0.00	0.00	0.00	23.40	14.25	14.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.25	14.25	14.25	14.25	-1.83	-1.88
Losses c/f	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	0.00	0.00	0.00	1.83	1.88
Corporation Tax	0.00	0.00	0.00	0.00	6.79	4.13	4.13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.13	4.13	4.13	4.13	0.00	0.00
Working Capital	0.00	0.00	0.00	0.00	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	3.26	0.00	0.00
Change in Working Capital	0.00	0.00	0.00	0.00	3.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-3.26	0.00
Cashflow	-7	-34	-34	-54	13	19	19	19	19	19	19	19	19	19	19	19	19	19	19	1	0
Cumulative Cashflow	-7	-41	-75	-129	-115	-96	-77	-58	-38	-19	0	20	39	58	77	97	116	135	154	156	156
DCFs @ 10.0%	-6.54	-31[illegible]	-28.28	-40.36	9.12	11.96	10.88	9.89	8.99	8.17	7.43	6.75	6.14	5.58	5.07	4.61	4.19	3.81	3.47	0.23	-0.01
NPV @ 10.0%	0																				

Figure 3.10: Illustration of the spreadsheet method of calculation used to compute the Discounted Cost of Aggregate Delivered.
The cash flow model is populated with values linked to the data area (as indicated with arrows). A trial value for the average commodity price (£/tonne) is then entered in cell A, and a corresponding trial value of Net Present Value at the modelled discount rate (10%) is computed in cell B. The value in cell A is then systematically adjusted using the MS Excel Solver utility such that the value in cell B returned is zero. Under these circumstances, the average commodity price represents the discounted cost of aggregate delivered, a break-even cost of production that leads to an indifference between investing in the project modelled and the next best alternative investment (that has a return rate of 10%).

3.10 The Reference Leicestershire 'SuperQuarry'

The assessment of the economic performance of a market price-making surface aggregates operation provided an objective basis for the comparison process required for the second part of Project Objective A.

Valuation models for surface quarrying operations were established such that the DCAD(10%) of aggregates produced from surface quarries could be determined. The methodology applied to compute these values was identical to that set out in section 3.9, with values for land procurement, development etc. set to reflect the surface quarrying situation (for example: clearly, shaft development time and capital cost are set to zero). For the surface quarrying options, the aggregates processing plant was assumed complete by the end of year 2 of the project and the capital expenditure allocated across these 2 pre-production years. Revenues were assumed realised from the beginning of year 3 of these projects.

A key distinction for these valuation models, in comparison to those developed for the underground mining cases, was that the surface operation location was more remote from the target market area than any of the underground operations modelled. Calculating these measures permitted direct comparison with those for the various underground options.

If the DCAD(10%) for a particular underground operation is the same as for surface quarries, then this represents an indifference to an economic argument not to utilise potential underground resources on the basis of cost. Put another way, under these circumstances, aggregates operators would be faced with an equivalence of choice between an underground aggregates mine located fairly close to a population centre and a quarry located further way from its export demand centre. Having computed the DCADs for both surface and underground aggregates operations, their comparison allowed Project Objective B to be achieved.

The surface quarry reference case was for a quarry located 70 miles from the M25 motorway in Leicestershire, but connected to the rail distribution network and delivering 50% of output by rail to the target market area, 20% by 8 wheel, 4 axle rigid bodied trucks to the immediate market 25 miles around the site and 30% by articulating tipping trucks to customers over 25 miles around the site. The freehold of the complete site was assumed owned by the operator which obviated the need to separate mineral rights from the freehold and implied zero royalty payments to 3rd parties. The production intensity was set at 3,500,000 million tonnes per annum (MTPA), placing this quarry in the so-called 'SuperQuarry' category. The thickness of overburden was assumed negligible and the quarry operating life was assumed to be 50 years.

This was considered a challenging but realistic reference case to consider the underground operation against. The reference case was also recomputed for production intensities of 0.375, 0.625 and 1.25 million tonnes per annum to permit further comparisons to be made. The resulting DCAD(10%) values are as follows:

Leicestershire 'SuperQuarry' producing 3.5 million tonnes per annum	DCAD(10%) = £10.95 / tonne
Leicestershire 'Quarry' producing 1.25 million tonnes per annum	DCAD(10%) = £16.48 / tonne
Leicestershire 'Quarry' producing 0.625 million tonnes per annum	DCAD(10%) = £18.52 / tonne
Leicestershire 'Quarry' producing 0.375 million tonnes per annum	DCAD(10%) = £23.63 / tonne

Note that in the last two cases, the quarries were assumed too small to warrant construction of a rail head and connection to the rail network, and thus it was assumed that 50% of production volume was delivered by rigid body trucks to the immediate area around the quarry with the remaining 50% delivered by articulated trucks to longer range markets.

Sensitivity of the DCAD(10%) of the Reference Leicestershire SuperQuarry was investigated for varying lengths of project life. The results (Table 3.11) indicate negligible sensitivity of the DCAD(10%) with project lives greater than 30 years, and a 6.5% higher value for a project life of 15 years (which would be considered rather short for a quarrying operation). For these reasons a value of £10.95 / tonne was adopted as a reference figure against which DCAD(10%) values arising from the underground aggregates mines could be compared. Although the other figures noted above are included on the figures in Section 4 for reference purposes.

Table 3.11: Sensitivity of the discounted cost of aggregate delivered (10%) for varying production life of the Reference Leicestershire 'SuperQuarry'.

Project Life	DCAD(10%) (£/tonne)	Sensitivity against 50 year value
(years)	14,000 tpd	(%)
10	12.54	114.5
15	11.66	106.5
20	11.28	103.0
25	11.10	101.4
30	11.01	100.5
35	10.97	100.2
40	10.95	100.0
45	10.95	100.0
50	10.95	100.0

The development capital intensity is another important metric for aggregates operators entertaining developing new crushed rock aggregates production capacity. For the Reference Leicestershire SuperQuarry, the development capital costs are £92.10 million (Table 3.12) and this maximum cash exposure for the development occurs in year 3 of the project, after the processing plant is complete.

Table 3.12: Schedule of capital cost items for Reference Leicestershire SuperQuarry (£)

Item	CAPEX
Feasibility, Permit, Engineering	4,208,009
Land procurement	883,133
Quarry	22,590,757
Plant	61,569,428
Railhead	1,249,279
Environmental compliance	1,573,690
Total	92,074,297

4 Land designation screening

The feasibility of underground mining of aggregates depends on more than just the presence of potential areas of resource. One of the primary considerations in any future feasibility study will be the accessibility of those resources. This part of the research aims to examine the possible constraints that exist in the vicinity of the potential areas of resource.

The main constraints to mineral extraction are:
- Environmental designations, e.g. National Park, Site of Special Scientific Interest (SSSI), etc
- Urban areas

The degree of constraint posed by the above is not identical to the constraint they would pose to a surface extraction site. This is because the land surface over an underground mining void can be left undisturbed. However, this project has assumed that the processing equipment for an underground aggregates mine would be on the surface and therefore space close to the underground resource is necessary for this. In addition, access to an underground resource requires either a shaft or a decline with a dip of ~10°. In the latter option, the distance to the edge of potential resource will have a direct correlation with the depth of the target rock

4.1 Environmental Designations

For the purposes of this research the term ‘environmental designations’ includes areas designated and protected for landscape, nature conservation or heritage reasons. Within this there are a wide variety of designations ranging from those recognised internationally, such as World Heritage Sites or Special Protection Areas, through national sites, such as National Parks or Areas of Outstanding Natural Beauty, to others which are of local importance, such as Local Nature Reserves. The large number of different designations means that it is not possible, nor appropriate, to include all possible designations in this research. Descriptions of many of these designations, including whether they have a statutory basis, are available in Steadman, et al (2004) together with comments relating to the significance, or ‘value’, of each type. Brief details of the ones used in this research are included in Table 4.1 and these are delineated in Figure 4.1.

It is important to remember that environmental designations do not all impose the same degree of constraint on mineral extraction (whether at the surface or for the surface expression of underground mining). Indeed, it is the limited nature of the constraint which has informed the decision to specifically exclude certain designations from this research. The designations used here are the ones that are considered to impose the greatest constraint on mineral extraction, but no account has been made of the relative degrees of constraint caused between them, i.e. they are all treated equally as areas where mineral extraction should be avoided.

Environmental designations are not necessarily mutually exclusive. For example an area designated as a Ramsar Site, may also be classified as a SSSI, SPA and/or SAC. Within the study area used for this research a few small locations can have as many as seven different designations. However, such overlapping designations are not treated as ‘extra special’ in this research but are considered equal to areas with only one designation.

Boundary files for the designations used in this research were obtained via links on the website ‘Multi-Agency Geographic Information for the Countryside’ (www.magic.gov.uk), from either Natural England or English Heritage. Details relating to the accuracy or precision of this linework are shown in Table 4.2 together with their version dates. It should be remembered that boundary information can change with time, either by new designated areas being added or existing boundaries being refined. Consequently any maps derived from these datasets should be considered as a ‘snapshot’ in time. Designations outside the study area are not shown on Figure 4.1.

Table 4.1: Brief details of Environmental Designations used in this research

Type of Designation	Level	Examples in Study Area	Source of designation
World Heritage Site	International	Maritime Greenwich, Blenheim Palace, Canterbury Cathedral, Royal Botanical Gardens Kew, Tower of London, Westminster Palace & Abbey	UNESCO World Heritage Convention
Special Protection Area (SPA)	International	Thames Basin Heaths, Medway Estuary & Marshes, Nene and Ouse Washes, Thanet Coast & Sandwich Bay, Lea Valley, etc.	European Union Directive on the Conservation of Wild Birds
Special Area of Conservation (SAC)	International	Windsor Forest & Great Park, Kennet & Lambourn Floodplain, Oxford Meadows, Chiltern Beechwoods, Parkgate Down, Epping Forest, etc.	European Union Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna
Ramsar Site	International	Medway Estuary & Marshes, Wicken Fen, Thames Estuary & Marshes, Lea Valley, South West London Waterbodies, Chippenham Fen, Broadland, etc	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
National Park	National	New Forest, South Downs, the Broads	National Parks and Access to the Countryside Act 1949, as subsequently amended
Area of Outstanding Natural Beauty (AONB)	National	Chichester Harbour, High Weald, Suffolk Coast & Heaths, North Wessex Downs, Surrey Hills, Cotswolds, Chilterns, Kent Downs, Dedham Vale, etc.	National Parks and Access to the Countryside Act 1949, and Countryside and Rights of Way Act 2000
Site of Special Scientific Interest (SSSI)	National	Boxford Water Meadows, Whitehorse Hill, Lodge Wood & Stanford Mill, Aston Rowant Cutting, Wormsley Chalk Banks, Windsor Forest & Great Park, Pixey & Yarnton Meads, etc.	National Parks and Access to the Countryside Act 1949, Wildlife and Countryside Act 1981, and the Countryside and Rights of Way Act 2000
Scheduled Ancient Monument	National	Many small sites including Roman remains, City walls, moated buildings, Anglo-Saxon sites, medieval remains, etc.	Ancient Monuments and Archaeological Areas Act 1979, and the Town and Country Planning Act 1990
National Nature Reserve (NNR)	National	Kings Wood, Burnham Beeches, Collyweston Great Wood, Dungeness, Hatfield Forest, Colne Estuary, etc.	Natural England (owned or leased by them or another ‘approved body’)

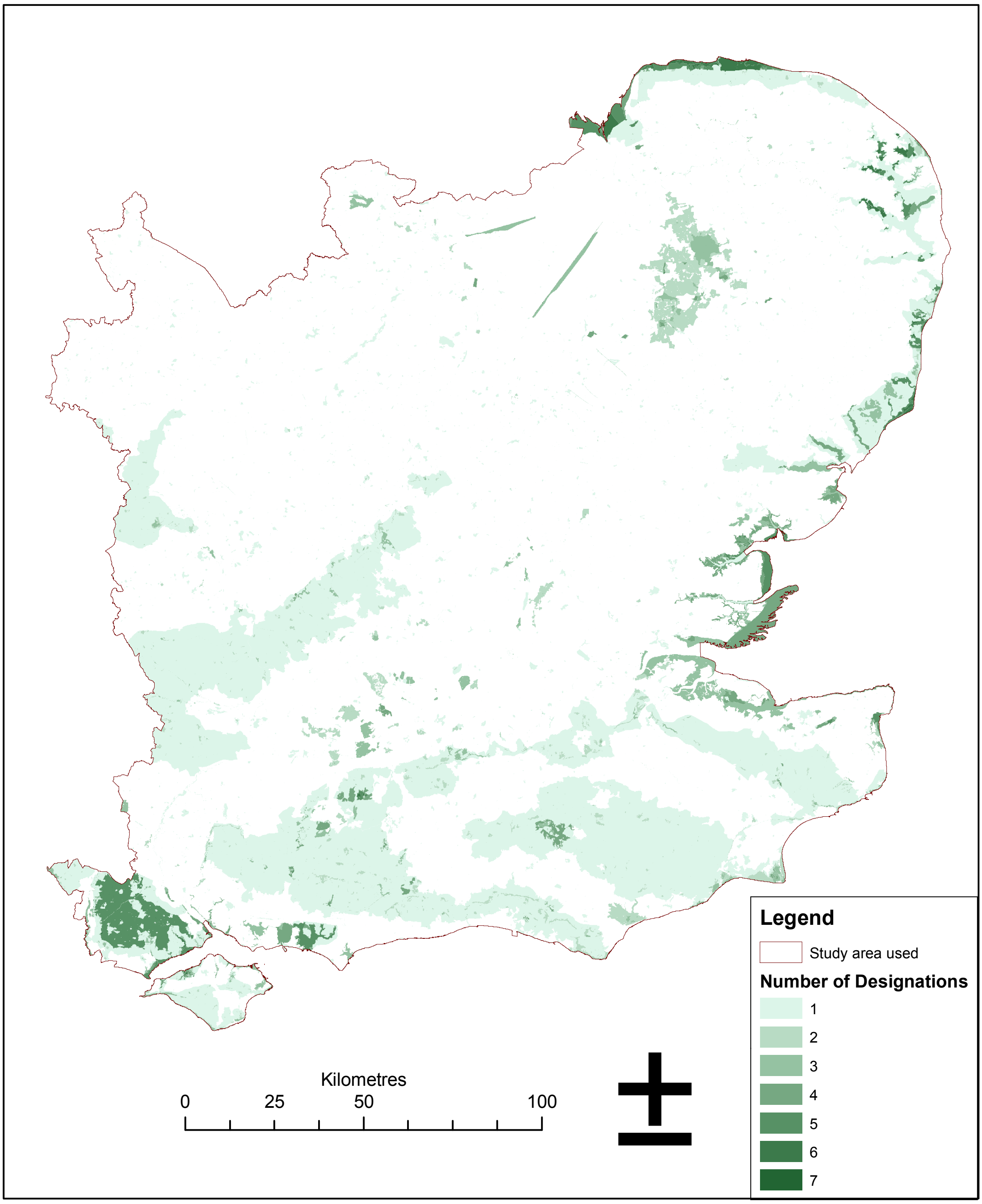


Figure 4.1: Areas covered by the environmental designations which are used in this research

4.2 Urban Areas

As described earlier, the degree of constraint posed by urban areas is not the same for underground mining as it is for surface quarrying. Clearly a surface quarry cannot be constructed where there are buildings already in existence. However, the void created by extraction in an underground mine, in theory, could be located beneath an urban area provided it has been engineered correctly to avoid the risk of subsidence. There are many locations already within the UK where this does occur, and indeed many other types of voids underneath towns and cities, including for example the underground train network in London, various pipes for utilities, road tunnels and in some cases rivers that have been diverted through culverts.

Nevertheless, it is assumed in this research that the aggregates processing plant and associated buildings will be located on the surface and it is therefore appropriate to consider where these might be located in relation to the potential areas of resource. Surface quarrying is one of the most disliked types of land-use in the UK (Saint Consulting, 2009) and it is likely that the surface expression of an underground aggregates mine would engender similar reactions from the general public.

The urban areas within the region of this research are shown at Figure 4.2. At the regional scale it is not possible to include every individual building, but this map aims to include the majority of clusters of buildings down to a reasonably fine scale. This map clearly shows the significant numbers of buildings in the proximity of London but also illustrates the difficulties that are incurred when attempting to locate mineral extraction facilities away from the population centres of England. On the other hand, it is these very same population centres that generate the demand for aggregates in the first place, as described in Brown, et al (2008), and consequently locating these facilities close to urban areas has advantages in terms of reducing transport distances, and the associated carbon dioxide emissions.

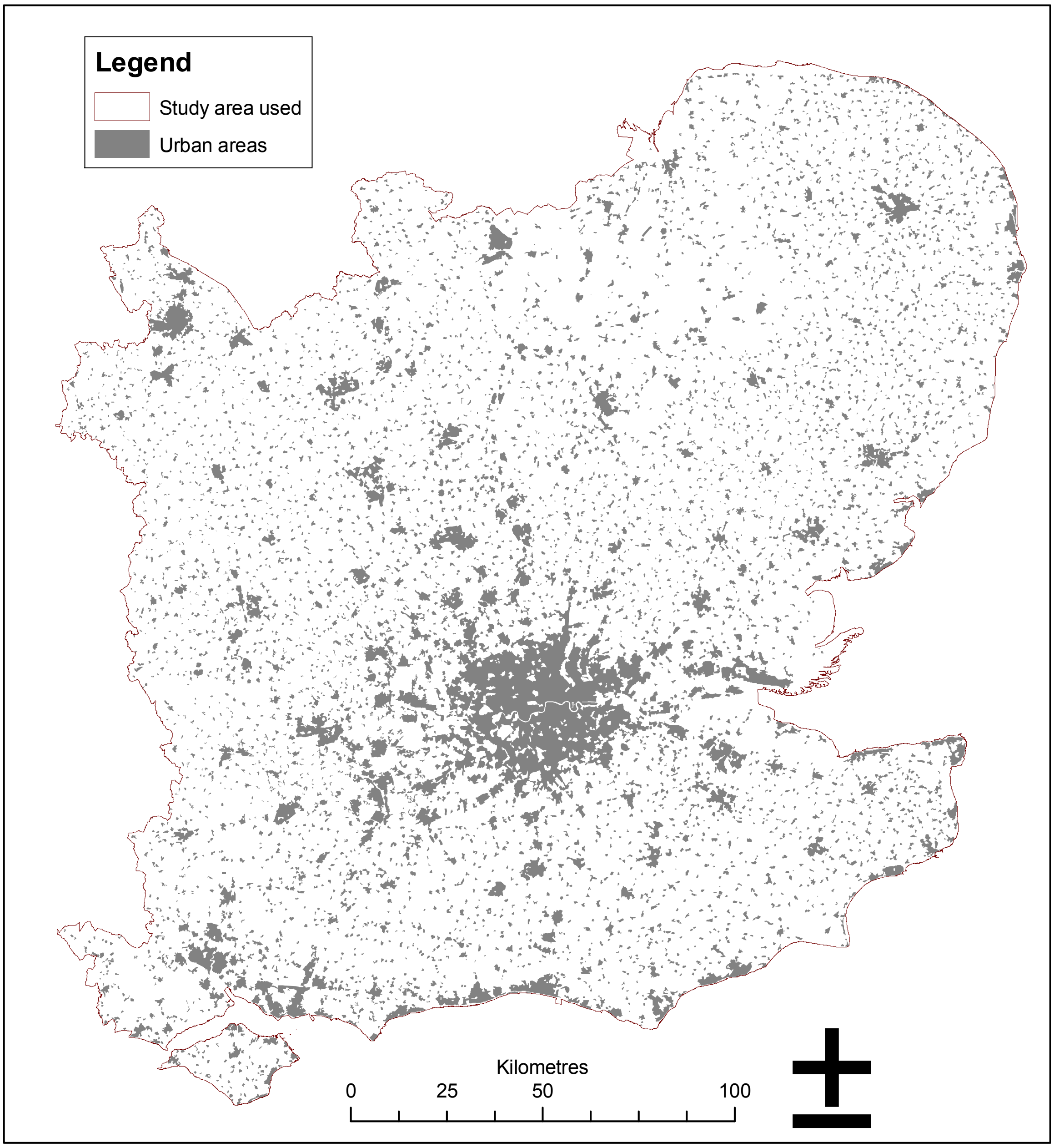


Figure 4.2: Urban areas within the southern and eastern region of England

Table 4.2: Accuracy and precision of data sets used in GIS analysis.

Type of Designation	Source *	Accuracy	Precision	Version Date
World Heritage Site	English Heritage	Captured from paper maps at 1:10,000 scale, +/- 0.1mm from original source	Data captured with co-ordinate precision of 1 metre	9/3/2009
Special Protection Area (SPA)	Natural England	Designation maps digitised at 1:1250 or 1:1000 scale	Data captured with co-ordinate precision of 1 metre	1/10/2009
Special Area of Conservation (SAC)	Natural England	Designation maps digitised at 1:1250 or 1:1000 scale	Data captured with co-ordinate precision of 1 metre	1/10/2009
Ramsar Site	Natural England	Designation maps digitised at 1:1250 or 1:1000 scale	Data captured with co-ordinate precision of 1 metre	1/10/2009
National Park	Natural England	Captured from mixed scale paper maps, +/- 0.5mm from original source	Data captured with co-ordinate precision of 1 metre	26/1/2009
Area of Outstanding Natural Beauty (AONB)	Natural England	Captured from mixed scale paper maps, +/- 0.5mm from original source	Data captured with co-ordinate precision of 1 metre	1/8/2009
Site of Special Scientific Interest (SSSI)	Natural England	Designation maps digitised at 1:1250 or 1:1000 scale	Data captured with co-ordinate precision of 1 metre	1/10/2009
Scheduled Ancient Monument	English Heritage	Captured at various scales from 1:10,000 to 1:1250, +/- 0.1mm from original source	Data captured with co-ordinate precision of 1 metre	15/10/2009
National Nature Reserve (NNR)	Natural England	Designation maps digitised at 1:1250 or 1:1000 scale	Data captured with co-ordinate precision of 1 metre	1/10/2009

Table A1: Source of original datasets for Environmental Designations, with comments on accuracy, precision and version date

* Sources remain the copyright owners of original datasets, used with permission on the basis of academic research.

5 Estimation of supply of aggregates using underground mining methods in the South East of England.

Sixty-two boreholes drawn from the BGS borehole database were initially considered as being representative of mineable aggregates prospects. The locations of the boreholes were screened using a GIS analysis to determine whether or not they were within areas of land with designations that may preclude development of a mine. Of the 62 boreholes, 20 are located within land areas with designations that may preclude mine development. Consequently, these were eliminated from further analysis. The land designations and other information relevant to the valuations of the borehole prospects are presented in Table 5.1.

It is appropriate to state at the outset that this approach was adopted because it permitted consideration of hypothetical underground aggregates developments at credible geographic locations, with some hard evidence that aggregates horizons may actually be available at those locations. Assumptions had to be made regarding whether aggregates horizons were present in sufficient quantity to sustain an operating aggregates mine, but these were informed by information on the thickness of identified horizons and inferences concerning continuity. <u>This approach does not mean that it is in any way certain that formally defined aggregates resources or reserves will ever actually exist at the aggregates prospect locations considered in the analysis.</u>

For each prospect, the combinations of feasible options that could be considered for the exploitation of each prospect (as set out in 3.3) were exhaustively enumerated. During this search, each combination had its DCAD(10%) computed and the combination with the lowest DCAD(10%) was taken to be the optimal manner in which to exploit the prospect. This search was constrained by limiting the operating life of the underground aggregates mine to 50 years. Lower operational lives were possible; these instances are constrained by low assessments of available “resource” for a prospect. Aggregates Levy was included in all valuations at the 2007 rate of £1.60 / tonne.

The search was repeated for each of the prospects such that at the end of the process, a solution set of optimally exploited resource prospects resulted. Each prospect was ranked by its DCAD(10%) (lowest being best) and then aggregated to form an estimate of a possible underground aggregates production industry supply curve for the South East area of England.

The results presented in the various sections of this Chapter together form an extensive investigation of uncertainty, or variance, of findings. Had there been a rather restricted set of parameters defining the characteristics for underground aggregates mines, a conventional sensitivity analysis with the production of so-called ‘spider diagrams’ may have been appropriate. However as the operational defining parameters are numerous (see Table 5.1) the alternative approach of scenario analysis is adopted. Normally, this involves consideration of only: most likely scenario and best case and worst case scenarios. This three estimate approach is not appropriate for the current work because does not appropriately treat the various spatial dependencies such as geological formation, distance to M25, distance to rail, prospect depth, current land use, etc. Instead, each prospect site is considered an individual scenario informed by what is known about each potential prospect site, and the scenario analysis extends across the 62 BGS borehole scenarios. For each scenario, what is known of each site is entered into the valuation model (Table 5.1). Prospects passing land use screening are passed to an optimisation procedure that establishes the optimal i) mining method, ii) access method, iii) stoping layout and iv) production rate. This information is passed to a valuation model that looks up cost information from the databases established to identify capital costs, operating costs and haulage costs corresponding to each scenario. The cost information is then used to establish the valuation measure, the DCAD(10%), for the prospect scenario.

After all borehole prospects have been considered in this optimisation and valuation process, the range of values for the DCAD(10%) indicates the likely variance, or uncertainty, or sensitivity in outcomes— conditioned by what is known about each scenario.

However, as each scenario also corresponds to an actual prospect location where a hypothetical underground aggregates mine has been considered, an opportunity to structure the outcomes by ranking them by increasing DCAD(10%) has been taken. The result is a prospect ‘merit order’ (cheapest producers first). The ranked values can be compared with increasing delivered price for aggregate to indicate which of the prospective mines would produce under the economic break-even condition implied by the DCAD(10%). The result is that the ranked values effectively form an estimate of the long term supply curve for the potential UK underground crushed rock aggregate industry. As this would be a competitive industry, with a minority market share in comparison with established large scale surface quarry crushed rock aggregate producers, the surface quarries would define the market price (they are the price makers) and the underground mines would have to be able to operate economically facing this competition (they are the price takers).

Consequently, for convenience in indicating the relative competitiveness of a potential UK underground aggregates mining sector with existing surface aggregates producers, the DCAD(10%) values of surface producers are also plotted with the underground crushed rock aggregate industry supply curve, and these should be interpreted as price levels. Prospective underground aggregates producers within the supply curve plotting below the price level should be interpreted as effectively competing with surface quarries, those plotting above the price curve should be interpreted as not being able to effectively compete.

Within this Chapter, the scenario analysis procedure described is repeated under several sector-wide assumptions.

After the base case circumstances of:

- no underground space utilisation after exploitation
- no concurrent use or after use of surface land has been considered
- and a 50 year mine life,

has been considered (Section 5.1), the problem is revisited to examine the sensitivity of outcomes to a mine life capped at 15 years duration (Section 5.2). In Section 5.3 the sensitivity of the outcomes to a change of discount rate used in the DCAD valuation measure is reported. It is an increasingly frequent circumstance that instead of procuring freehold and hence rights to exploit aggregates within the freehold, aggregates operators procure mineral rights from a 3rd party freeholder and do not take outright title of land, but take a lease. The sensitivity of this circumstance to the outcomes set out earlier is presented in Section 5.5, using the land use values reported in Section 5.4. In Section 5.7, the sensitivity of outcomes considering a capital credit to the aggregates operator for sale of the remediated surface land and underground space is explored. Due to the effect of discounting processes, this is only relevant for specific cases where the mine production life is relatively short, here capped at 15 years. In Section 5.8, the sensitivity of outcomes considering rent obtainable by an underground aggregates operator for concurrent use of surface land above underground workings is explored. As the areal extent of underground workings for a mine with a producing life of 15 years is unlikely to extend beyond the land-take footprint of the surface expression of the mine, these specific considerations of sensitivity are only relevant to mines with a long production life, here assumed to be 50 years.

Thus, overall this Chapter indicates likely variance, uncertainty, or sensitivity for a specific sector-wide assumption by forming the corresponding underground aggregates mining supply curve. Sensitivity to varying sector wide assumptions is explored through reproduction of revised supply curves computed under the various additional constraints.

Table 5.1: Valuation information for each borehole 'prospect'.

Borehole	Lithology	Depth (m)	Thick (m)	Cover geology % Thickness Soil/MG	SST	DOLO	CHLK	DBASE	Dist to Rail (miles)	"Prospect Scale"	Haul to M25 (miles)	Landtype Purchase	Environmental Designations WHS	AONB	SPA	SAC	Ramsar	SSSI	SAM	NNR	NP	Total No.
Littlebourne	LMST_C	797	1.37	0.1	17	4	78	0	1.4	Small	42	Agricultural	n	n	n	n	n	n	n	n	n	0
Kingsdown	LMST_C	904	14.65	0.1	19	0	81	0	2.7	Large	25	Agricultural	n	n	n	n	n	n	n	n	n	0
Ringwould	LMST_C	1076	14.3	0.1	17	4	78	0	0.5	Large	53	Agricultural	n	n	n	n	n	n	n	n	n	0
Betteshanger 2DB	LMST_C	798	5.3	0.1	17	4	78	0	2.2	Small	50	Agricultural	n	n	n	n	n	n	n	n	n	0
Chslet 34DB	LMST_C	510	3.9	0.1	19	0	81	0	0.11	Small	45	Agricultural	n	n	y	y	y	y	n	y	n	5
Chislet 35DB	LMST_C	660	1	0.1	19	0	81	0	1.3	Small	45	Agricultural	n	n	n	n	n	n	n	n	n	0
Adisham	LMST_C	987	8.22	0.1	17	4	78	0	0.2	Medium	45	Agricultural	n	n	n	n	n	n	n	n	n	0
Fleet	LMST_C	582	15.84	0.1	31	0	69	0	0.9	Large	47	Agricultural	n	n	n	n	n	n	n	n	n	0
Barnsole	LMST_C	813	22.21	0.1	19	0	81	0	3.2	Large	48	Agricultural	n	n	n	n	n	n	n	n	n	0
Betteshanger BH	LMST_C	887	5.79	0.1	17	4	78	0	2.6	Small	50	Agricultural	n	n	n	n	n	n	n	n	n	0
Betteshanger 7DB	LMST_C	791	3.81	0.1	17	4	78	0	1.3	Small	52	Agricultural	n	n	n	n	y	y	n	n	n	2
Bishopsbourne	LMST_C	910	20.06	0.1	17	4	78	0	1.8	Large	44	Agricultural	n	y	n	n	n	n	n	n	n	1
Chislet Park	LMST_C	808	319.1	0.1	19	0	81	0	0.7	Very Large	45	Agricultural	n	n	n	n	n	n	n	n	n	0
Chislet 39DB	LMST_C	525	2.74	0.1	19	0	81	0	0.04	Small	44	Agricultural	n	n	y	y	y	y	n	y	n	5
Chitty	LMST_C	344	269.8	4	15	0	81	0	1	Very Large	45	Agricultural	n	n	n	n	n	n	n	n	n	0
Ebbsfleet	LMST_C	353	70.01	6	20	0	74	0	0.6	Very Large	52	Industrial	n	n	y	y	y	y	n	n	n	4
Elham	LMST_C	698	17.37	0.1	17	4	78	0	4	Large	43	Agricultural	n	y	n	n	n	n	n	n	n	1
Harmansole	LMST_C	387	7.92	0.1	17	4	78	0	2.9	Medium	41	Agricultural	n	y	n	n	n	n	n	n	n	1
Little Duskin	LMST_C	686	16.39	0.1	21	8	70	0	4.2	Large	43	Agricultural	n	y	n	n	n	n	n	n	n	1
Lydden Valley	LMST_C	597	20.72	0.1	19	0	81	0	0.4	Large	54	Agricultural	n	n	y	n	y	y	n	n	n	3
Meggot Farm	LMST_C	1339	10.18	0.1	17	4	78	0	4.4	Medium	49	Agricultural	n	y	n	n	n	n	n	n	n	1
Mattice Hill	LMST_C	625	7.31	0.1	19	0	81	0	0.3	Small	57	Agricultural	n	n	n	n	y	y	n	n	n	2
Oxney	LMST_C	1128	12.19	0.1	18	1	80	0	0.5	Medium	52	Agricultural	n	y	n	n	n	n	y	n	n	2
Paddlesworth Court	LMST_C	1129	11.79	3	20	2	75	0	1.8	Medium	45	Agricultural	n	y	n	n	n	n	n	n	n	1
Ripple	LMST_C	966	45.11	0.1	20	4	76	0	1	Very Large	53	Agricultural	n	n	n	n	n	n	n	n	n	0
Rushbourne	LMST_C	424	312.6	0.1	32	0	68	0	2.4	Very Large	43	Agricultural	n	n	n	n	n	y	n	n	n	1
Stodmarsh	LMST_C	654	35.66	0.1	19	1	80	0	1	Very Large	44	Agricultural	n	n	n	n	n	n	n	n	n	0
Tollgate	LMST_C	509	8.91	2	15	0	83	0	0.6	Medium	53	Agricultural	n	n	n	y	n	y	n	n	n	2
Trapham	LMST_C	846	135.33	2	23	11	64	0	1.6	Very Large	45	Agricultural	n	n	n	n	n	n	n	n	n	0
Walmestone	LMST_C	694	2.74	0.1	19	0	81	0	3.7	Small	47	Agricultural	n	n	n	n	n	n	n	n	n	0
Woodnesborough	LMST_C	799	3.65	0.1	20	3	77	0	2.1	Small	50	Agricultural	n	n	n	n	n	n	n	n	n	0
Bletchley	GRANITE	115	9	0.1	74	26	0	0	0.1	Small	31	Industrial	n	n	n	n	n	n	n	n	n	0
Bicester	VOLC	386	128	0.1	51	49	0	0	0.4	Very Large	35	Industrial	n	n	n	n	n	n	n	n	n	0
Withycombe Farm	VOLC	1034	29	0.1	89	11	0	0	2	Large	79	Agricultural	n	n	n	n	n	n	n	n	n	0
Byfield	VOLC	773	11	0.1	89	11	0	0	8	Small	53	Agricultural	n	n	n	n	n	n	n	n	n	0
GH10	QTZT	275	12	0.1	82	18	0	0	8.5	Medium	55	Agricultural										
GST2	VOLC	253	16	0.1	92	8	0	0	1.6	Medium	60	Agricultural	n	n	n	n	n	n	n	n	n	0
Upwood	VOLC	191	23	0.6	25	74	0	0	2.4	Medium	50	Agricultural	n	n	n	n	n	y	n	y	n	2
Warboys	VOLC	170	46	0.8	26	73	0	0	3.9	Very Large	46	Agricultural	n	n	n	n	n	n	y	n	n	1
Steeple Aston	BASA	611	165	0.1	89	11	0	0	1.3	Very Large	43	Agricultural	n	n	n	n	n	n	n	n	n	0
Burnt Hill	BASA	1049	123	0.1	43	13	44	0	4.5	Very Large	29	Agricultural	n	y	n	n	n	n	n	n	n	1
Aston Tirrold	BASA	614	86	0.1	85	14	0.8	0	0.8	Very Large	29	Agricultural	n	y	n	n	n	n	n	n	n	1
Strat B1	DOLR	746	5	1	57	9	33	0	0.03	Small	24	Agricultural	n	n	n	n	n	n	n	n	n	0
Akeman Street	DOLR	350	31	0.1	77	23	0	0	2.9	Very Large	37	Agricultural	n	n	n	n	n	n	n	n	n	0
Northbrook	BASA	498	19	0.1	86	14	0	0	3	Medium	42	Agricultural	n	n	n	n	n	n	n	n	n	0
Milton	DOLR	720	100	0.1	95	5	0	0	2.8	Very Large	46	Agricultural	n	n	n	n	n	n	n	n	n	0
Warkworth	BASA	665	8	0.1	94	6	0	0	0.5	Small	47	Agricultural	n	n	n	n	n	n	n	n	n	0
Overthorpe Rd	BASA	715	14	0.1	96	4	0	0	0.8	Small	48	Industrial	n	n	n	n	n	n	n	n	n	0
Calvert East	VOLC	174	1	0.7	76	23	0	0	0.05	Small	37	Agricultural	n	n	n	n	n	n	n	n	n	0
Sonning Eye	BASA	593	48	0.2	67	5	28	0	1.3	Very Large	19	Industrial	n	n	n	n	n	n	n	n	n	0
Old Barn	BASA	779	36	0.1	96	4	0	0	2.6	Large	49	Agricultural	n	n	n	n	n	n	n	n	n	0
Ells Farm	BASA	903	8	0.1	97	3	0	0	3.9	Small	50	Agricultural	n	n	n	n	n	n	n	n	n	0
Vicarage Farm	VOLC	517	6	0.1	88	12	0	0	0.6	Small	42	Agricultural	n	n	n	n	n	n	n	n	n	0
Oxendon Hall	VOLC	232	15	0.5	86	13	0	0	2.4	Medium	55	Agricultural	n	n	n	n	n	n	n	n	n	0
Orton	VOLC	218	22	0.1	86	14	0	0	3.5	Medium	50	Agricultural	n	n	n	n	n	n	n	n	n	0
Hollies Barn	VOLC	934	61	0.1	97	3	0	0	5	Very Large	48	Agricultural	n	n	n	n	n	n	n	n	n	0
Hollowell	VOLC	336	24	0.1	91	9	0	0	3.4	Medium	55	Agricultural	n	n	n	n	n	n	n	n	n	0
Cottage Homes	VOLC	192	3	14	86	0	0	0	1.9	Small	68	Agricultural										
Crouch Farm	BASA	879	4	0.1	97	3	0	0	2.9	Small	52	Agricultural	n	n	n	n	n	n	n	n	n	0
Brickhouse Farm	BASA	776	15	0.1	96	4	0	0	3	Large	53	Agricultural	n	n	n	n	n	n	n	n	n	0
Bodicote	DOLR	738	17	0.1	97	3	0	0	0.8	Large	51	Agricultural	n	n	n	n	n	n	n	n	n	0
Brightling	LMST_J	708	148						2.9	Very Large	26	Agricultural	n	y	n	n	n	n	n	n	n	1

Geological abbreviations: LMST_C – Carboniferous limestone, GRANITE – Granite, QTZT – Quartzite, BASA – Basalt, DOLR- Dolerite, LMST_J – Jurassic limestone, VOLC – Volcanic, Soil/MG – Soil / Made Ground, SST – Sandstone, DOLO – Dolomite, CHLK – Chalk, DBASE – Diabase.

Landuse abbreviations: WHS – World Heritage Site, AONB – Area of Outstanding Natural Beauty, SPA – Special Protection Area, SAC – Special Area of Conservation, Ramsar - , SSSI – Site of Special Scientific Interest, SAM – Scheduled Ancient Monument, NNR – National Nature Reserve, NP – National Park.

Prospect Scale meanings: Small <= 50 million tonnes; 50 < Medium <= 90 million tonnes; 90 < Large <= 150 million tonnes; Very Large > 150 million tonnes.

5.1 *The 50-year base case*

For the scenario comprising:

- procurement of the freehold of all undermined land;
- a factor of safety of 1.8 for mine pillar design (meaning the probability of any surface expression is very low);
- a maximum 50 year mine life, unless the likely geology did not warrant this;
- no concurrent surface use of undermined land not part of the surface footprint of the underground mine;
- no surface after use benefits; and
- no underground space after use benefits

the resulting estimated supply curve for underground aggregates production for the South East area of England, presented in Figure 5.1, is referred to subsequently as the '50-year base case.'

In the case of each technically feasible prospect, the optimisation process identified a room-and-pillar mining method and a production rate of 3.5 MTPA. The latter production rate is the largest available in the mine cost database and represents a relatively high output for an underground mine adopting the room-and-pillar method of mining.

The 50-year base case chart demonstrates that underground aggregates mines, within or close to the market demand centre, have costs that lie higher than those of the Leicestershire SuperQuarry which has a DCAD(10%) of £10.95/tonne and lower than those of a Leicestershire Quarry delivering crushed rock aggregate at a rate of 1.25 MTPA with a DCAD(10%) of £16.48 (with the exception of 4 prospects). Of the complete set of 62 boreholes the land designation screening process eliminated 20 from consideration and a further 11 were eliminated as the intersection thickness was less than the minimum for room-and-pillar mining, 8 metres.

The DCAD(10%) computation process identifies the optimal production method, access type and production rate of the underground aggregates prospects and also their life-of-mine data.

The best six underground aggregates prospects in the 50-year base case (Figure 5.1) are listed in Table 5.2.

Table 5.2: Prospects with the lowest DCAD(10%) for the 50-year base case

Prospect	Distance to M25	Depth	Access	Aggregate Geology	DCAD(10%)
Chitty	45 miles	344m	Shaft	Carboniferous Limestone	£13.03/tonne
Bicester	35 miles	386m	Shaft	Volcanics	£13.38/tonne
Sonning Eye	19 miles	593m	Shaft	Basalt	£13.65/tonne
Stodmarsh	44 miles	654m	Shaft	Carboniferous Limestone	£13.66/tonne
Fleet	47 miles	582m	Shaft	Carboniferous Limestone	£13.71/tonne
Steeple Aston	43 miles	611m	Shaft	Basalt	£13.93/tonne

Production from the top four of these six prospects would amount to 14 million tonnes per year which approximately matches the 13.4 million tonnes per annum that was imported into the South East area of England in 2005 (see Table 1.1). The trend identifiable in this subset of the results is that the DCAD(10%) increases with increasing depth of the potential aggregate horizon, and reduces with reduced distance from the target market area. Despite its greater distance from the target market area, Chitty outperforms Bicester because it processes the less demanding limestone material rather than volcanic material (meaning that the plant capital and operating costs are lower). The full set of results for the 50-year base case assumptions is presented in Table 5.3.

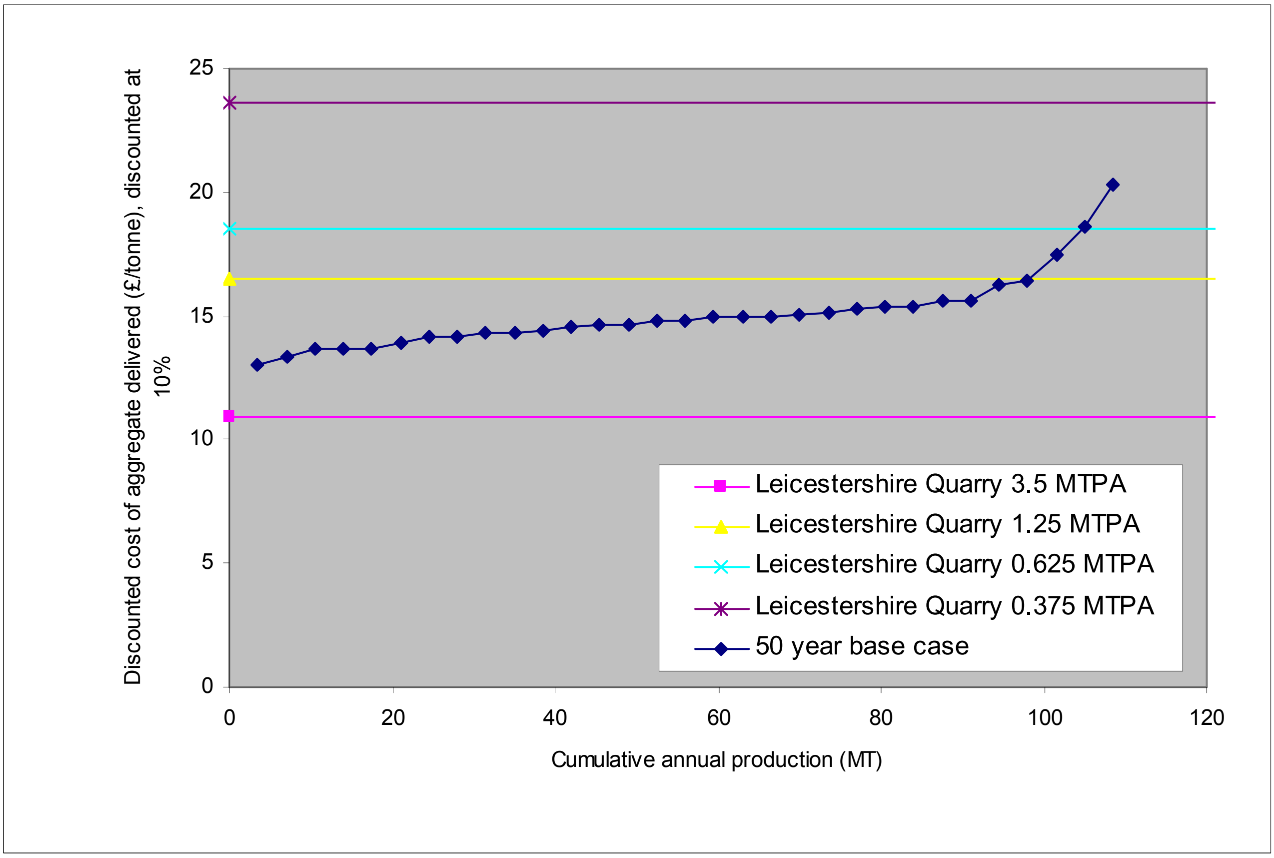


Figure 5.1: 50 year base case underground aggregates prospect supply curve for the South East area of England also showing relative DCAD(10%) values for the reference Leicestershire surface aggregates quarries.

Total capital cost costs for the underground aggregates mine prospects set out in Table 5.3 range from £120.73 million for the prospect at Bletchley, 31% higher than the Reference Leicestershire SuperQuarry, to £144.50 million for the prospect at Ellis Farm, 57% higher. The higher capital intensity for development of an underground aggregates mine in comparison to that for the surface option could represent a significant disincentive for aggregates operators investing in new underground aggregates production capacity, unless new non-cost pressures (such as planning policy) meant that new surface quarrying capacity became unavailable as an option.

Table 5.3: 50 year base case - Optimised underground aggregates mine valuation model parameters, ranked by DCAD(10%).

Borehole / Prospect	Lithology	Depth (m)	Thickness (m)	Prod Rate (kTPD)	Method	Access	Water	Mine life (years)	Dist to rail (miles)	Dist to M25 (miles)	Haulage Cost (£/tonne)	Mine CAPEX (£million)	Plant CAPEX (£million)	Mine OPCOST (£/tonne)	Plant OPCOST (£/tonne)	Total CAPEX (£million)	Total OPCOST (£/tonne)	FOS	Extraction Ratio	DCAD (10%) (£/tonne)	Land available for concurrent use (ha)	Prod Rate (MTPA)	Cumulative Annual Prod (MTPA)	Recovered "Resource" (MT)	Prod CO_2eq/tonne	Haul CO_{2eq}/tonne	Total CO_{2eq}/tonne
Chitty	LMST_C	**344**	270	14	R&P	Shaft	wet	50	1	**45**	2.74	74.32	50.74	2.45	0.61	135.22	7.40	1.8	0.68	**13.03**	59	3.5	3.5	175	10.16	4.09	14.25
Bicester	VOLC	**386**	128	14	R&P	Shaft	dry	50	0.4	**35**	2.60	67.90	61.57	2.40	0.97	139.86	7.57	1.8	0.65	**13.38**	59	3.5	7	175	10.16	3.13	13.28
Sonning Eye	BASA	**593**	48	14	R&P	Shaft	wet	46	1.3	**19**	1.92	75.26	61.57	2.45	0.97	147.33	6.94	1.8	0.73	**13.65**	30	3.5	10.5	161	10.16	2.00	12.16
Stodmarsh	LMST_C	**654**	36	14	R&P	Shaft	wet	50	1	**44**	2.73	76.21	50.74	2.45	0.61	137.60	7.39	1.8	0.50	**13.66**	104	3.5	14	175	10.16	3.98	14.14
Fleet	LMST_C	**582**	16	14	R&P	Shaft	wet	30	0.9	**47**	2.78	74.14	50.74	2.45	0.61	134.77	7.44	1.8	0.54	**13.71**	29	3.5	17.5	105	10.16	4.31	14.47
Steeple Aston	BASA	**611**	165	14	R&P	Shaft	dry	50	1.3	**43**	2.71	71.93	61.57	2.40	0.97	143.91	7.68	1.8	0.72	**13.93**	39	3.5	21	175	10.16	3.87	14.03
Orton	VOLC	**218**	22	14	R&P	Adit	dry	21	3.5	**50**	3.54	59.63	61.57	2.26	0.97	129.41	8.37	1.8	0.76	**14.13**	0	3.5	24.5	73.5	6.51	6.24	12.76
Bodicote	DOLR	**738**	17	14	R&P	Shaft	dry	32	0.8	**51**	2.87	71.61	61.57	2.40	0.97	143.44	7.84	1.8	0.59	**14.16**	23	3.5	28	112	10.16	4.73	14.89
Akeman Street	DOLR	**350**	31	14	R&P	Shaft	dry	50	2.9	**37**	3.70	65.86	61.57	2.40	0.97	136.33	8.67	1.8	0.75	**14.34**	43	3.5	31.5	175	10.16	4.54	14.70
Trapham	LMST_C	**846**	135	14	R&P	Shaft	wet	50	1.6	**45**	2.74	82.91	50.74	2.45	0.61	145.04	7.40	1.8	0.39	**14.36**	151	3.5	35	175	10.16	4.09	14.25
GH10	QTZT	**275**	12	14	R&P	Adit	dry	23	8.5	**55**	3.69	64.86	61.57	2.26	0.97	134.84	8.52	1.8	0.72	**14.41**	0	3.5	38.5	80.5	6.51	6.68	13.19
Chislet Park	LMST_C	**808**	319	14	R&P	Shaft	wet	50	0.7	**45**	2.74	86.16	50.74	2.45	0.61	148.35	7.40	1.8	0.41	**14.52**	140	3.5	42	175	10.16	4.09	14.25
Hollowell	VOLC	**336**	24	14	R&P	Shaft	dry	23	3.4	**55**	3.69	65.54	61.57	2.40	0.97	135.61	8.66	1.8	0.68	**14.61**	0	3.5	45.5	80.5	10.16	6.68	16.84
GST2	VOLC	**253**	16	14	R&P	Adit	dry	15	1.6	**60**	3.22	62.84	61.57	2.26	0.97	133.97	8.05	1.8	0.74	**14.62**	0	3.5	49	52.5	6.51	5.42	11.94
Old Barn	BASA	**779**	36	14	R&P	Shaft	dry	34	2.6	**49**	3.55	72.53	61.57	2.40	0.97	143.05	8.52	1.8	0.68	**14.82**	11	3.5	52.5	119	10.16	6.10	16.26
Milton	DOLR	**720**	100	14	R&P	Shaft	dry	50	2.8	**46**	3.58	72.61	61.57	2.40	0.97	143.65	8.55	1.8	0.60	**14.82**	71	3.5	56	175	10.16	5.67	15.83
Barnsole	LMST_C	**813**	22	14	R&P	Shaft	wet	42	3.2	**48**	3.56	79.58	50.74	2.45	0.61	139.92	8.22	1.8	0.41	**14.96**	108	3.5	59.5	147	10.16	5.96	16.12
Ripple	LMST_C	**966**	45	14	R&P	Shaft	wet	50	1	**53**	2.95	83.64	50.74	2.45	0.61	146.21	7.61	1.8	0.32	**14.98**	197	3.5	63	175	10.16	4.88	15.04
Brickhouse Farm	BASA	**776**	15	14	R&P	Shaft	dry	28	3	**53**	3.63	72.17	61.57	2.40	0.97	142.57	8.60	1.8	0.68	**14.99**	0	3.5	66.5	98	10.16	6.50	16.66
Northbrook	BASA	**498**	19	14	R&P	Shaft	dry	18	3	**42**	3.62	67.95	61.57	2.40	0.97	138.14	8.59	1.8	0.76	**15.02**	0	3.5	70	63	10.16	5.10	15.26
Oxendon Hall	VOLC	**232**	15	14	R&P	Adit	dry	14	2.4	**55**	3.69	60.79	61.57	2.26	0.97	130.62	8.52	1.8	0.75	**15.09**	0	3.5	73.5	49	6.51	6.68	13.19
Hollies Barn	VOLC	**934**	61	14	R&P	Shaft	dry	50	5	**48**	3.56	75.30	61.57	2.40	0.97	147.38	8.53	1.8	0.34	**15.29**	174	3.5	77	175	10.16	5.96	16.12
Bletchley	GRANITE	**115**	9	14	R&P	Adit	dry	8	0.1	**31**	2.56	50.18	61.57	2.26	0.97	120.73	7.39	1.8	0.88	**15.34**	0	3.5	80.5	28	6.51	2.80	9.31
Ringwould	LMST_C	**1076**	14	14	R&P	Shaft	wet	27	0.5	**53**	2.95	85.22	50.74	2.45	0.61	147.14	7.61	1.8	0.26	**15.34**	113	3.5	84	94.5	10.16	4.88	15.04
Kingsdown	LMST_C	**904**	15	14	R&P	Shaft	wet	28	2.7	**25**	3.54	81.52	50.74	2.45	0.61	141.59	8.20	1.8	0.36	**15.60**	67	3.5	87.5	98	10.16	3.55	13.71
Overthorpe Rd	BASA	**715**	14	14	R&P	Shaft	dry	13	0.8	**48**	2.79	71.21	61.57	2.40	0.97	142.81	7.76	1.8	0.69	**15.62**	0	3.5	91	45.5	10.16	4.43	14.59
Adisham	LMST_C	**987**	8	14	R&P	Shaft	wet	15	0.2	**45**	2.74	83.05	50.74	2.45	0.61	144.01	7.40	1.8	0.31	**16.23**	17	3.5	94.5	52.5	10.16	4.09	14.25
Withycombe Farm	VOLC	**1034**	29	14	R&P	Shaft	dry	28	2	**79**	4.37	76.34	61.57	2.40	0.97	149.05	9.34	1.8	0.28	**16.39**	97	3.5	98	98	10.16	8.76	18.92
Byfield	VOLC	**773**	11	14	R&P	Shaft	dry	10	8	**53**	3.63	72.06	61.57	2.40	0.97	142.30	8.60	1.8	0.43	**17.49**	0	3.5	101.5	35	10.16	6.50	16.66
Warkworth	BASA	**665**	8	14	R&P	Shaft	dry	7	0.5	**47**	2.78	70.35	61.57	2.40	0.97	141.91	7.75	1.8	0.71	**18.63**	0	3.5	105	24.5	10.16	4.31	14.47
Ells Farm	BASA	**903**	8	14	R&P	Shaft	dry	7	3.9	**50**	3.54	74.01	61.57	2.40	0.97	144.50	8.51	1.8	0.64	**20.31**	0	3.5	108.5	24.5	10.16	6.24	16.40

Notes: Geological abbreviations: LMST_C – Carboniferous limestone, GRANITE – Granite, QTZT – Quartzite, BASA – Basalt, DOLR- Dolerite, LMST_J – Jurassic limestone, VOLC - Volcanics.
"Mine Life"=Operational life that could be supported by the prospect.
"Cumulative annual production"= is accumulated over the prospects returned by the optimising algorithm, ordered by increased DCAD(10%). This is useful to readily identify all those prospects that could contribute to annual production of crushed rock aggregates given a particular commodity price. For example, if the price for delivered aggregate was £14.00/tonne delivered, the top six quarries in the table would have a combined production of 21 million tonnes per annum (MTPA).
Recovered resource = Mine life x annual production rate

5.2 The 15-year base case

The 50-year base case scenario imposed a 50 year operating life for the underground aggregates mine, in the event that such a long mine life would be supported by the likely geology. Table 5.3 shows that 10 of the 31 aggregates prospect sites were affected by this threshold.

The results presented in this section arise from imposing a limit of 15 years on the mine life, to establish whether or not there will be a significant change on the form and location of the supply curves for underground aggregates production for the South East area of England. Table 5.3 shows that all but 8 of the 31 prospect sites should be affected by this measure.

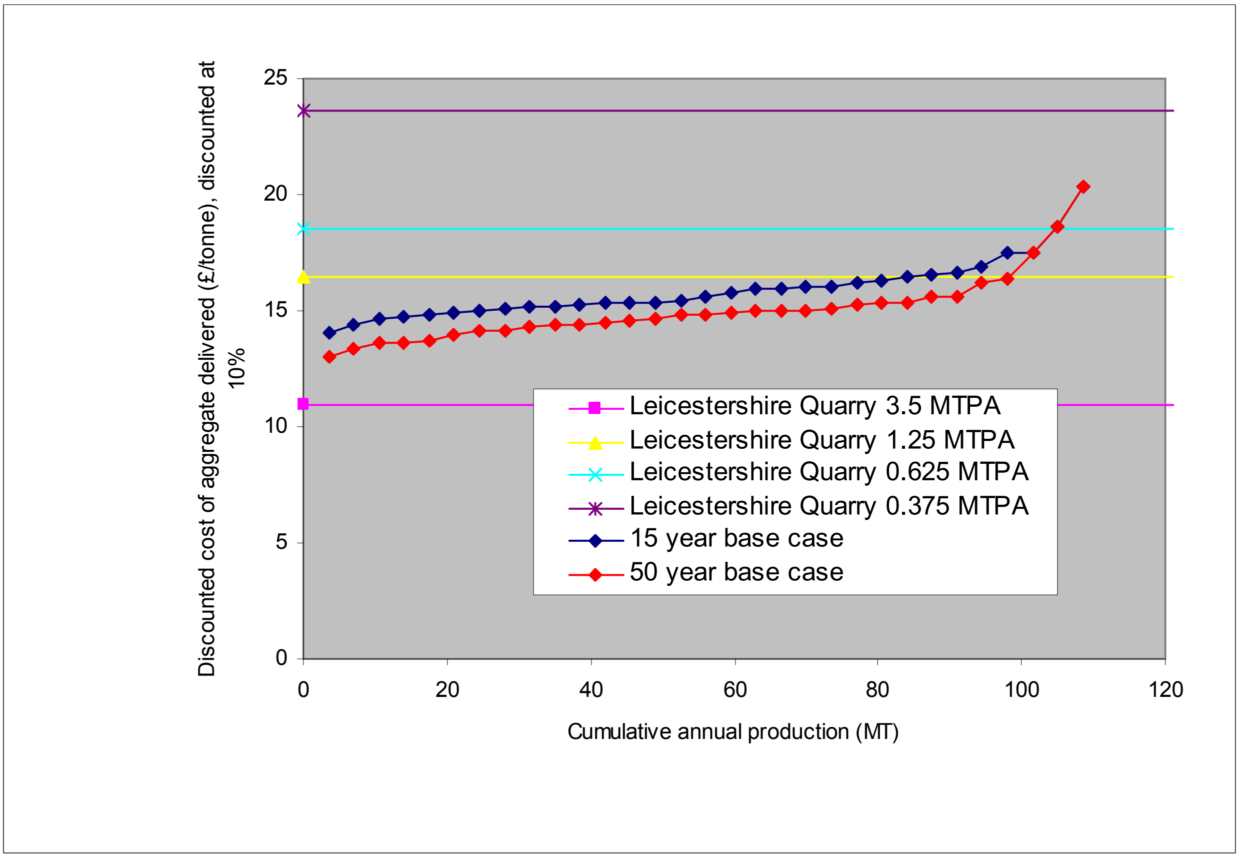


Figure 5.2: 15 year base case underground aggregates prospect supply curve for the South East area of England. Relative DCAD(10%) values for the reference Leicestershire surface aggregates quarries are also indicated.

Figure 5.2 indicates that the net effect of the constraint on operating life was to increase the DCAD(10%) for all affected quarries. This is because the year 15 to 50 contributions of operating net cash flows to the prospects' net present values are absent in the revised scenario. However, the effect is limited to a ~7% increase in DCAD(10%) for the more competitive mines, for a 70% reduction in their project life.

The 15 year operating life constrained underground aggregates supply curve of this section will form a new reference curve against which further scenarios are investigated and consequently, will be referred to as the "15-year base case".

Total capital cost costs for the underground aggregates mine prospects set out in Table 5.4 range from £120.73 million for the prospect at Bletchley, 31% higher than for the Reference Leicestershire SuperQuarry (see Table 3.12) to £148.39 million for the prospect at Withycombe Farm, 61% higher. The higher capital intensity for development of an underground aggregates mine in comparison to the surface quarrying option could represent a significant disincentive for aggregates operators investing in new underground aggregates production capacity, unless non-cost pressures (such as planning policy) meant that new surface quarrying capacity became unavailable as an option. Table 5.4 also shows that in the case of the 15 year mine life, only 6 of the 31 prospects have sufficient land on surface to support a concurrent use.

Table 5.4: 15 year base case - Optimised underground aggregates mine valuation model parameters, ranked by DCAD(10%)

Borehole / Prospect	Lithology	Depth (m)	Thickness (m)	Prod Rate (kTPD)	Method	Access	Water	Mine life (years)	Dist to rail (miles)	Dist to M25 (miles)	Haulage Cost (£/tonne)	Mine CAPEX (£million)	Plant CAPEX (£million)	Mine OPCOST (£/tonne)	Plant OPCOST (£/tonne)	Total CAPEX (£million)	Total OPCOST (£/tonne)	FOS	Extraction Ratio	DCAD (10%) (£/tonne)	Land available for concurrent use (ha)	Prod Rate (MTPA)	Cumulative Annual Prod (MTPA)	Recovered "Resource" (MT)	Prod CO_2eq/tonne	Haul CO_{2eq}/tonne	Total CO_{2eq}/tonne
Chitty	LMST_C	**344**	270	14	R&P	Shaft	wet	15	1	**45**	2.74	74.32	50.74	2.45	0.61	134.70	7.40	1.8	0.68	**14.05**	0	3.5	3.5	52.5	10.16	4.09	14.25
Bicester	VOLC	**386**	128	14	R&P	Shaft	dry	15	0.4	**35**	2.60	67.90	61.57	2.40	0.97	139.34	7.57	1.8	0.65	**14.43**	0	3.5	7	52.5	10.16	3.13	13.28
GST2	VOLC	**253**	16	14	R&P	Adit	dry	15	1.6	**60**	3.22	62.84	61.57	2.26	0.97	133.97	8.05	1.8	0.74	**14.62**	0	3.5	10.5	52.5	6.51	5.42	11.94
Orton	VOLC	**218**	22	14	R&P	Adit	dry	15	3.5	**50**	3.54	59.63	61.57	2.26	0.97	129.41	8.37	1.8	0.76	**14.72**	0	3.5	14	52.5	6.51	6.24	12.76
Fleet	LMST_C	**582**	16	14	R&P	Shaft	wet	15	0.9	**47**	2.78	74.14	50.74	2.45	0.61	134.51	7.44	1.8	0.54	**14.82**	0	3.5	17.5	52.5	10.16	4.31	14.47
Stodmarsh	LMST_C	**654**	36	14	R&P	Shaft	wet	15	1	**44**	2.73	76.21	50.74	2.45	0.61	136.68	7.39	1.8	0.50	**14.89**	0	3.5	21	52.5	10.16	3.98	14.14
Sonning Eye	BASA	**593**	48	14	R&P	Shaft	wet	15	1.3	**19**	1.92	75.26	61.57	2.45	0.97	147.07	6.94	1.8	0.73	**15.01**	0	3.5	24.5	52.5	10.16	2.00	12.16
Oxendon Hall	VOLC	**232**	15	14	R&P	Adit	dry	14	2.4	**55**	3.69	60.79	61.57	2.26	0.97	130.62	8.52	1.8	0.75	**15.09**	0	3.5	28	49	6.51	6.68	13.19
GH10	QTZT	**275**	12	14	R&P	Adit	dry	15	8.5	**55**	3.69	64.86	61.57	2.26	0.97	134.84	8.52	1.8	0.72	**15.14**	0	3.5	31.5	52.5	6.51	6.68	13.19
Steeple Aston	BASA	**611**	165	14	R&P	Shaft	dry	15	1.3	**43**	2.71	71.93	61.57	2.40	0.97	143.57	7.68	1.8	0.72	**15.15**	0	3.5	35	52.5	10.16	3.87	14.03
Bodicote	DOLR	**738**	17	14	R&P	Shaft	dry	15	0.8	**51**	2.87	71.61	61.57	2.40	0.97	143.23	7.84	1.8	0.59	**15.29**	0	3.5	38.5	52.5	10.16	4.73	14.89
Bletchley	GRANITE	**115**	9	14	R&P	Adit	dry	8	0.1	**31**	2.56	50.18	61.57	2.26	0.97	120.73	7.39	1.8	0.88	**15.34**	0	3.5	42	28	6.51	2.80	9.31
Hollowell	VOLC	**336**	24	14	R&P	Shaft	dry	15	3.4	**55**	3.69	65.54	61.57	2.40	0.97	135.61	8.66	1.8	0.68	**15.35**	0	3.5	45.5	52.5	10.16	6.68	16.84
Akeman Street	DOLR	**350**	31	14	R&P	Shaft	dry	15	2.9	**37**	3.70	65.86	61.57	2.40	0.97	135.95	8.67	1.8	0.75	**15.37**	0	3.5	49	52.5	10.16	4.54	14.70
Northbrook	BASA	**498**	19	14	R&P	Shaft	dry	15	3	**42**	3.62	67.95	61.57	2.40	0.97	138.14	8.59	1.8	0.76	**15.41**	0	3.5	52.5	52.5	10.16	5.10	15.26
Overthorpe Rd	BASA	**715**	14	14	R&P	Shaft	dry	13	0.8	**48**	2.79	71.21	61.57	2.40	0.97	142.81	7.76	1.8	0.69	**15.62**	0	3.5	56	45.5	10.16	4.43	14.59
Trapham	LMST_C	**846**	135	14	R&P	Shaft	wet	15	1.6	**45**	2.74	82.91	50.74	2.45	0.61	143.72	7.40	1.8	0.39	**15.75**	0	3.5	59.5	52.5	10.16	4.09	14.25
Chislet Park	LMST_C	**808**	319	14	R&P	Shaft	wet	15	0.7	**45**	2.74	86.16	50.74	2.45	0.61	147.13	7.40	1.8	0.41	**15.96**	0	3.5	63	52.5	10.16	4.09	14.25
Old Barn	BASA	**779**	36	14	R&P	Shaft	dry	15	2.6	**49**	3.55	72.53	61.57	2.40	0.97	142.95	8.52	1.8	0.68	**15.98**	0	3.5	66.5	52.5	10.16	6.10	16.26
Milton	DOLR	**720**	100	14	R&P	Shaft	dry	15	2.8	**46**	3.58	72.61	61.57	2.40	0.97	143.03	8.55	1.8	0.60	**16.01**	0	3.5	70	52.5	10.16	5.67	15.83
Brickhouse Farm	BASA	**776**	15	14	R&P	Shaft	dry	15	3	**53**	3.63	72.17	61.57	2.40	0.97	142.57	8.60	1.8	0.68	**16.04**	0	3.5	73.5	52.5	10.16	6.50	16.66
Adisham	LMST_C	**987**	8	14	R&P	Shaft	wet	15	0.2	**45**	2.74	83.05	50.74	2.45	0.61	144.01	7.40	1.8	0.31	**16.23**	17	3.5	77	52.5	10.16	4.09	14.25
Barnsole	LMST_C	**813**	22	14	R&P	Shaft	wet	15	3.2	**48**	3.56	79.58	50.74	2.45	0.61	138.98	8.22	1.8	0.41	**16.31**	0	3.5	80.5	52.5	10.16	5.96	16.12
Ripple	LMST_C	**966**	45	14	R&P	Shaft	wet	15	1	**53**	2.95	83.64	50.74	2.45	0.61	144.60	7.61	1.8	0.32	**16.48**	14	3.5	84	52.5	10.16	4.88	15.04
Hollies Barn	VOLC	**934**	61	14	R&P	Shaft	dry	15	5	**48**	3.56	75.30	61.57	2.40	0.97	145.91	8.53	1.8	0.34	**16.58**	7	3.5	87.5	52.5	10.16	5.96	16.12
Ringwould	LMST_C	**1076**	14	14	R&P	Shaft	wet	15	0.5	**53**	2.95	85.22	50.74	2.45	0.61	146.44	7.61	1.8	0.26	**16.61**	34	3.5	91	52.5	10.16	4.88	15.04
Kingsdown	LMST_C	**904**	15	14	R&P	Shaft	wet	15	2.7	**25**	3.54	81.52	50.74	2.45	0.61	141.06	8.20	1.8	0.36	**16.87**	6	3.5	94.5	52.5	10.16	3.55	13.71
Byfield	VOLC	**773**	11	14	R&P	Shaft	dry	10	8	**53**	3.63	72.06	61.57	2.40	0.97	142.30	8.60	1.8	0.43	**17.49**	0	3.5	98	35	10.16	6.50	16.66
Withycombe Farm	VOLC	**1034**	29	14	R&P	Shaft	dry	15	2	**79**	4.37	76.34	61.57	2.40	0.97	148.39	9.34	1.8	0.28	**17.53**	22	3.5	101.5	52.5	10.16	8.76	18.92
Warkworth	BASA	**665**	8	14	R&P	Shaft	dry	7	0.5	**47**	2.78	70.35	61.57	2.40	0.97	141.91	7.75	1.8	0.71	**18.63**	0	3.5	105	24.5	10.16	4.31	14.47
Ells Farm	BASA	**903**	8	14	R&P	Shaft	dry	7	3.9	**50**	3.54	74.01	61.57	2.40	0.97	144.50	8.51	1.8	0.64	**20.31**	0	3.5	108.5	24.5	10.16	6.24	16.40

Notes: Geological abbreviations: LMST_C – Carboniferous limestone, GRANITE – Granite, QTZT – Quartzite, BASA – Basalt, DOLR- Dolerite, LMST_J – Jurassic limestone, VOLC - Volcanics.
"Mine Life"=Operational life that could be supported by the prospect.
"Cumulative annual production"= is accumulated over the prospects returned by the optimising algorithm, ordered by increased DCAD(10%). This is useful to readily identify all those prospects that could contribute to annual production of crushed rock aggregates given a particular commodity price. For example, if the price for delivered aggregate was £15.00/tonne delivered, the top six quarries in the table would have a combined production of 21 million tonnes per annum (MTPA).
Recovered resource = Mine life x annual production rate

5.3 Sensitivity of Discounted Cost of Aggregate Delivered on discount rate

The use of a discount rate of 10% throughout all valuation calculations has been explained in section 3.2. For completeness, results of flexing the discount rate on the values of DCAD(i) for varying values of the discount rate, i, are presented (Table 5.5) –for both base cases.

Table 5.5: Sensitivity of DCAD(i) for 50 year base case (upper) and 15 year base case (lower) surface quarrying and underground aggregates mining operations.

Discount Rate (%)	Reference Leicestershire Quarry - 50 year operational life				Underground prospects	
	3.5 MTPA (£/tonne)	1.25 MTPA (£/tonne)	0.625 MTPA (£/tonne)	0.375 MTPA (£/tonne)	Bletchley (Adit) (£/tonne)	Bicester (Shaft) (£/tonne)
0	7.69	9.96	11.22	12.79	11.80	8.29
5	9.07	12.72	14.27	17.30	13.46	10.49
10	10.95	16.48	18.52	23.63	15.34	13.38
15	13.03	20.65	23.27	30.73	17.42	16.61
20	15.22	25.02	28.27	38.24	19.72	20.04

Discount Rate (%)	Reference Leicestershire Quarry - 15 year operational life				Underground prospects	
	3.5 MTPA (£/tonne)	1.25 MTPA (£/tonne)	0.625 MTPA (£/tonne)	0.375 MTPA (£/tonne)	Bletchley (Adit) (£/tonne)	Bicester (Shaft) (£/tonne)
0	8.96	12.53	14.28	17.40	11.80	10.28
5	10.18	14.96	16.95	21.34	13.46	12.15
10	11.66	17.91	20.26	26.26	15.34	14.43
15	13.38	21.34	24.13	32.05	17.42	17.10
20	15.29	25.17	28.50	38.60	19.72	20.10

The results presented are as expected. At a discount rate of *i* =10%, the DCAD(i%) is approximately 8% higher for the underground prospects compared to the 3.5 MTPA Leicestershire Quarry. This rises to 22% when *i* = 10%. As these reflect favourable circumstances for the underground mining option, these figures are consistent with the value of 20% at least stated by a UK Aggregates company, as reported by Mankelow *et al.*, 2008. As the discount rate increases, so the discounted cost of aggregate delivered increases for each of the aggregates operations presented. Entries in the upper row of each of the tables are the relative costs of aggregate delivered free from the effects of discounting and the time value of money as the discount rate is zero. These confirm the fundamental observation that the 3.5 MTPA reference surface quarrying operation is the most economically competitive. The result for the Bicester prospect indicates that although aggregate cannot be produced and delivered as cheaply from underground workings, the operations could compete very strongly. The non-discounted figures in the lower part of Table 5.5 are higher than those of the upper part of Table 5.5 simply because the same total capital costs are allocated across fewer total produced tonnes of aggregate, due to a shorter production life.

In adopting the DCAD as a valuation measure, the discounting process aims to account for differences in timing of cash flow. DCAD values for the underground mines increase more rapidly with increasing discount rate because the development times are typically longer for the underground operations. In appraisal of each prospect, the timings of capital expenditures are modelled explicitly and individually across development, operations, decommissioning, restoration and after use phases and account for the differences in DCAD for very similar shaft depths and similar distances to market. For similar operations, the distinctions in timings of capital expenditure, as well as the distinctions in the amounts of these expenditures can lead to minor re-ordering of rank of prospects when results are presented as in Table 5.3 or Table 5.4, for increasing discount rates.

The key distinction between the Bletchley prospect and the Bicester prospect presented in Table 5.5 is that the Bicester prospect scale is 'Very Large' whereas the Bletchley prospect scale is 'Small'. The optimal search for mining method and production rate led to the same solution in these two cases – room-and-pillar mining at 3.5 MTPA. The 'Small' prospect scale for Bletchley means that it only has a producing life of 8 years. Thus the thresholds of 50 operational years or 15 operational years considered in the base cases are irrelevant to the Bletchley prospect as it will only have a producing life of 8 years in both base cases. This is why the DCAD figures in the upper and lower parts of Table 5.5 are the same for the Bletchley prospect.

As the discount rate becomes higher, the influence of cash flows realised in later operational years diminishes with the result that the values in the upper part Table 5.5 and the lower part of Table 5.5 converge to the same values at large discount rates. It is only at lower discount rates that distinctions in economic performance arising from very long producing lives can be clearly observed.

5.4 Land values, development costs and realisable rents

It is noted at this early stage of considerations relating to specific concurrent or after-uses, that the postulated uses could themselves be considered potentially controversial with the public as well as attract additional scrutiny or conditions from planning authorities. Such issues of controversy are not explored in any detail in this Chapter as the research objective is simply to try to quantify their economic potential to aggregates producers. Nevertheless, the potential project development obstacles associated with such issues should not be underestimated by the reader, and such issues are discussed further in Appendix B of this report.

The 2007 Government Valuation Office Property report (VOA, 2007) was the prime source of information on realisable land values, development costs for specified land uses and net realisable revenues (rents) for developed land with a specified land use. HM Treasury data on the capital value and schedule of unitary payments for Private Finance Initiative (PFI) projects were also adopted to establish a land values database for use in the valuation computations (HM Treasury, 2009). Where the financial close year did not correspond to 2007, the PFI data were adjusted for the effect of inflation using ONS cost and price indices (ONS, 2009). The values for PFI projects were taken to apply across all regions.

In both cases, the primary data source did not necessarily report values in £/ha, which were required for the current valuation model. The PFI data required further estimation of the land areas for each of the contracts and these estimates were obtained by visiting the site locations using Google Earth and measuring the land areas with software tools. The values actually used in the underground aggregates mine valuation models are presented in Table 5.6 to Table 5.8.

A wind energy development model was also incorporated into the database. The figure for capital cost of 76,841 £/ha was based on selection of Vestas V52, 850kW wind turbines with an installed capital cost of £1100/kW of installed capacity and spacing between turbines of 9 times the rotor diameter in the direction of prevailing wind and 5 times rotor diameter in the direction perpendicular to the prevailing wind direction. Net revenues for the turbines were established by assuming a capacity factor of 0.3 for each wind turbine and using an electricity value of £0.06/kWh which accounts for all ‘green tariff’ benefits realised through a power purchase agreement (PPA). Turbine operating and maintenance costs were estimated as 5% of the installed capital cost of the development per annum. Capital expenditure and net revenue figures (rents) were then normalised by the expected area of developments.

A second renewable energy project use was also incorporated into the land values database. This was a large scale biomass development akin to those either at Eye in Suffolk (12.7MW, ~2 ha, £33 million) or Thetford (38.5MW, ~3.9ha, £16.7 million) in Norfolk. For the latter, the net cash flow after payments for feedstocks, operating and maintenance and green tariff credits such as the Renewables Obligation amount to £9 million per annum. Again, here capital development values and net revenue values were normalised by the gross site area on which the facilities were developed.

The values for both renewable energy land uses were taken to apply across all regions.

Within the valuation model, mine decommissioning and restoration works are assumed to be undertaken and completed in the year after aggregate extraction operations cease. The precise year in which this land sale credit will be realised depends on the time taken for shaft construction and hence mine primary development. For a shaft construction time of three years, mine development time of one year and an operating life of 15 years, the credit will be received in (and discounted from) year 19 of the project.

PFI projects, being public sector projects, are frequently built on low cost land. Consequently, in the mine valuation model the capital values of undeveloped land sold by the aggregates producer to a PFI consortium for a PFI after use are assumed to be the same prices that can be realised for the sale of agricultural land.

Table 5.6: Capital values (£/ha) of undeveloped land, where end use is designated, by region

Region / End Use	Project Life	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	South East	South West	Wales	Inner London	Outer London	Scotland
Agriculture	20	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
Residential - Small	20	2,840,000	2,970,000	2,940,000	2,370,000	2,500,000	3,790,000	3,950,000	3,150,000	2,630,000	12,020,000	7,580,000	2,010,000
Residential - Bulk	20	2,590,000	2,880,000	2,550,000	2,190,000	2,350,000	4,200,000	3,830,000	2,690,000	2,520,000	9,825,000	6,990,000	2,140,000
Industrial	20	167,000	470,000	641,000	450,000	568,000	1,119,000	1,499,000	717,000	236,000	2,285,000	2,285,000	296,000
Commercial	20	235,000	620,000	844,000	588,000	667,000	1,369,000	1,676,000	848,000	302,000	2,810,000	2,810,000	664,000
Retail	20	8,607,769	6,493,046	8,434,655	6,981,560	7,632,250	7,414,600	8,101,945	7,661,226	5,292,091	12,258,154	8,399,053	5,648,316
PFI - Sewage Treatment	25	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
PFI - Waste 2 Energy	25	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
PFI - Barracks	50	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
PFI - Courts	50	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
PFI - Leisure Centre	50	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
PFI - Govt Office Refurb	30	235,000	620,000	844,000	588,000	667,000	1,369,000	1,676,000	848,000	302,000	2,810,000	2,810,000	664,000
PFI - Prison	50	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
Wind Farm	25	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458
Biomass Plant	25	4,940	7,155	6,402	8,831	6,346	7,956	8,764	7,997	3,459	0	0	4,458

Table 5.7: Capital cost (£/ha) of developing land from an undeveloped state, to an intended end use (excluding the cost of procurement of land) by region.

Region / End Use	Project Life	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	South East	South West	Wales	Inner London	Outer London	Scotland
Agriculture	20	0	0	0	0	0	0	0	0	0	0	0	0
Residential - Small	20	1,488,571	1,505,750	1,354,545	1,367,708	1,530,000	1,820,833	1,985,000	1,639,167	1,506,250	2,150,000	2,546,429	1,543,571
Residential - Bulk	20	7,736,971	7,497,084	6,551,909	6,533,667	7,462,200	9,277,833	10,559,733	9,002,059	7,194,000	19,266,944	13,515,429	8,779,493
Industrial	20	2,867,500	2,143,869	2,675,250	2,201,042	2,181,375	2,456,833	4,261,508	3,326,750	2,083,531	4,252,500	4,252,500	2,829,556
Commercial	20	13,183,182	14,305,325	15,921,909	14,593,818	14,571,636	17,797,667	22,707,242	17,418,529	12,396,864	28,565,000	27,329,545	15,282,212
Retail	20	20,084,794	15,150,441	19,680,862	16,290,306	17,808,583	17,300,733	18,904,537	17,876,195	12,348,213	28,602,358	19,597,790	13,179,404
PFI - Sewage Treatment	25	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257	7,683,257
PFI - Waste 2 Energy	25	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109	14,609,109
PFI - Barracks	50	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866	2,505,866
PFI - Courts	50	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313	48,431,313
PFI - Leisure Centre	50	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825	10,287,825
PFI - Govt Office Refurb	30	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920	59,774,920
PFI - Prison	50	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682	3,386,682
Wind Farm	25	76,841	76,841	76,841	76,841	76,841	76,841	76,841	76,841	76,841	76,841	76,841	76,841
Biomass Plant	25	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192	16,675,192

Table 5.8: Revenue (£/ha) realised from land developed to an intended end use by region.

Region / End Use	Project Life	North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	South East	South West	Wales	Inner London	Outer London	Scotland
Agriculture	20	107	155	138	191	137	172	189	173	75	0	0	96
Residential - Small	20	216,429	223,788	214,727	186,885	201,500	280,542	296,750	239,458	206,813	708,500	506,321	177,679
Residential - Bulk	20	516,349	518,854	455,095	436,183	490,610	673,892	719,487	584,603	485,700	1,454,597	1,025,271	545,975
Industrial	20	246,000	273,631	307,375	278,333	279,375	351,389	447,026	334,886	232,813	575,208	501,042	292,347
Commercial	20	738,000	820,893	922,125	835,000	838,125	1,054,167	1,341,078	1,004,659	698,438	1,725,625	1,503,125	877,042
Retail	20	2,076,750	1,603,890	2,006,460	1,680,038	1,840,675	1,788,881	1,830,309	1,767,416	1,390,624	3,004,283	2,125,367	1,374,809
PFI - Sewage Treatment	25	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294	1,614,294
PFI - Waste 2 Energy	25	842,126	842,126	842,126	842,126	842,126	842,126	842,126	842,126	842,126	842,126	842,126	842,126
PFI - Barracks	50	498,786	498,786	498,786	498,786	498,786	498,786	498,786	498,786	498,786	498,786	498,786	498,786
PFI - Courts	50	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086	10,093,086
PFI - Leisure Centre	50	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304	1,207,304
PFI - Govt Office Refurb	30	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537	7,894,537
PFI - Prison	50	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405	2,060,405
Wind Farm	25	7,279	7,327	7,311	7,363	7,310	7,345	7,362	7,345	7,247	7,173	7,173	7,269
Biomass Plant	25	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790	2,301,790

5.5 Effect of separating mineral rights from freehold

Within the valuation models, land holdings are divided into:

- that portion of land required for construction of the surface facilities of the underground aggregates mine, including the crushing and screening plant (the surface footprint of the underground aggregates mine), and;
- that portion of land that lies outside this surface footprint but will be undermined by the extraction operations.

The total area of land undermined is determined after the extraction ratio of the underground mining method is computed. The extraction ratio is computed for a factor of safety of pillar stability of 1.8 in all cases, a value that will not preclude any particular land use above the workings for fear of surface disturbance.

Each of the prospect sites considered for valuation have been appraised for their current land use coverage using Google Earth. For all but 1 of the prospect sites, the current land use is agricultural. As a result, both the 50-year and 15-year base case scenarios assume that when freehold land for the underground mining operation is procured, it is done so at rates corresponding to agricultural land, drawn from Table 5.6.

The 50 year and 15 year base case scenarios assumed that the aggregates operator procured the freehold all of the land required above the underground development and thus simultaneously acquired the mineral rights for the property as the freeholder.

It is an increasingly frequent circumstance that instead of procuring freehold and hence rights to exploit aggregates within the freehold, aggregates operators procure mineral rights from a 3rd party freeholder and do not take outright title of land, but take a lease. The effect of this circumstance for underground aggregates mines in the South East area of England is presented in this section.

In securing the mineral rights rather than freehold, a royalty becomes payable to the freeholder. From the 2008 UK Minerals Yearbook (Bide *et al.*, 2008), the UK average royalty paid to freeholders for aggregates was £0.45/tonne, rising to £0.65/tonne and £0.90/tonne for the East of England and South East regions of England respectively.

The effects of this option in the valuation model set up are as follows:

- the effective operating cost per tonne increases due to royalty; and,
- the total capital expenditure reduces due to no longer requiring the procurement of freehold title.

Figure 5.3 shows the result of applying the revisions to the 50-year base case. The effect of not securing the freehold of the land within which the aggregates will be exploited is to cause a rise in the DCAD(10%) for all prospects. In the valuation calculations, the increase in input costs is not compensated by the reduction in total capital expenditure.

The implication of this result is that it will be more cost effective for underground aggregate mining operations to secure freehold rather than securing mineral rights only, and paying a royalty. As a result, the former circumstance is adopted in all subsequent analyses.

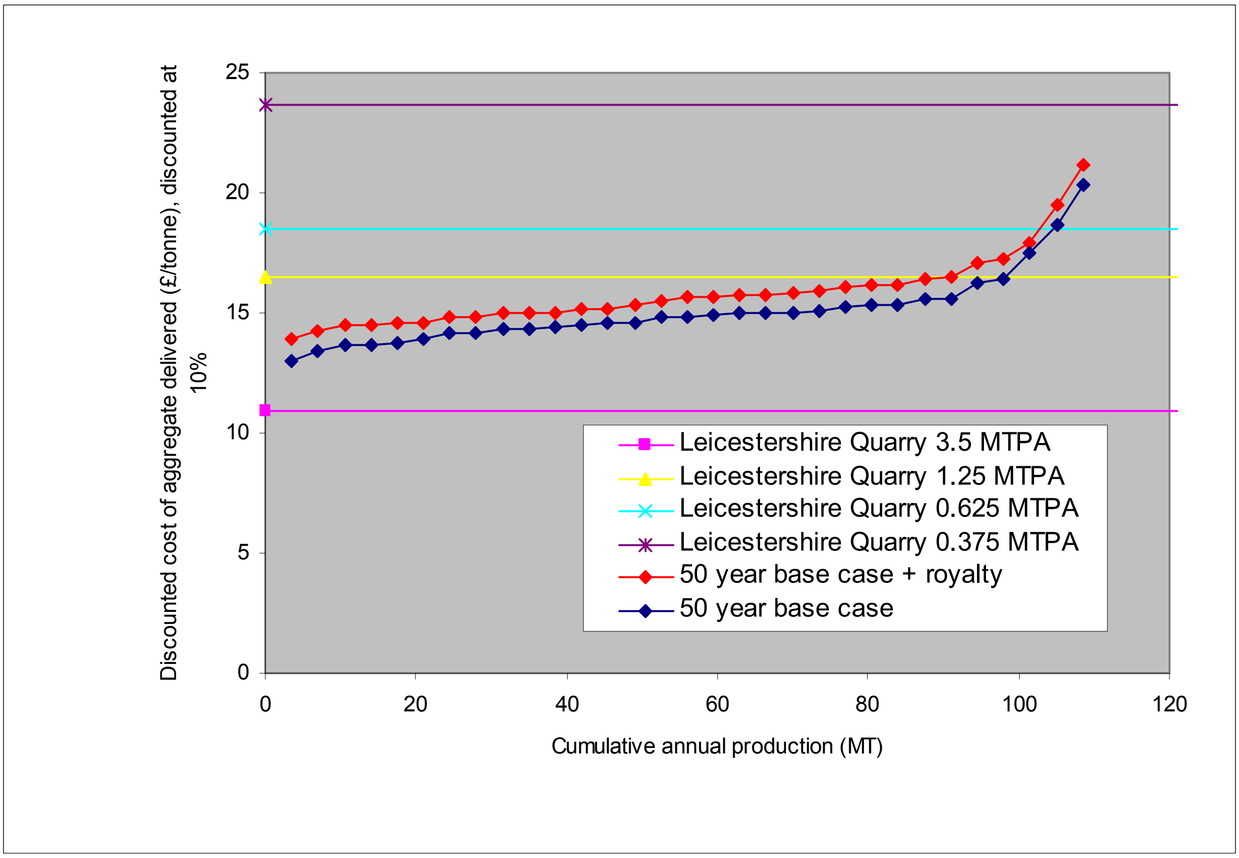


Figure 5.3: 50 year base case underground aggregates prospect supply curve for the South East area of England additionally reflecting the scenario of separating the mineral rights from the freehold ownership of the land.

5.6 Concurrent use and after use effects on mine feasibility

Undoubtedly concurrent developments and after use developments both on surface and in underground voids created by aggregates mining will add a multiplicity of additional development complexity arising from environmental, planning, public perception, public health, even human rights considerations. For this reason, a detailed discussion of potential after use types and potential implications and repercussions is presented in Appendix B. Readers with specific interests in these issues should consult Appendix B immediately before progressing to the following, which focuses on the economic deliberations, central to the research, only.

In Sections 5.1 and 5.2 potentially beneficial effects of concurrent and after use credits on the prospect valuation were not considered; both the 50-year base case and 15-year base case scenarios do not assign any value to remediated land or underground space that is sold at the end of the project life.

The reason for this is that after-use land sale credits only have a significant effect on project value (and hence the DCAD(10%)) for projects of relatively short duration. The present value of a capital credit due to the sale of land for a particular after use, realised at the end of the operating life, is significantly diminished by the discounting process. The present value factor for a year 18 cash flow discounted at 10% is 24% and the present value factor for a year 53 cash flow discounted at 10% is 0.6%; a capital credit of £1,000,000 received at the end of the project life would contribute £240,000 and £6,000 to the net present value of each of these projects, respectively. This also means that when the project life is long, after-use values are of reduced relevance to the relative economic feasibility of surface quarries and underground aggregates mines, whether these are for surface or underground after-uses.

In the 15-year base case, where the mine operational life was capped at 15 years, the optimisation process indicated that only in the cases of the very deepest prospects where extraction ratios are very low, would mine workings be expected to extend beyond the boundary of the mine surface footprint. Consequently for scenarios based on the 15-year base case, aggregates operators would not need to procure land in excess of that required for the underground mine surface footprint and so there would be no excess land held by the aggregates operator available for a concurrent development to be considered in the valuation model.

The overall consequences of these deliberations are that:

- valuation benefits of after-uses of both remediated surface land and underground space can only be assessed against the 15-year base case; and
- valuation benefits of concurrent uses of land held by the aggregates operator outside the underground mine surface footprint can only be assessed against the 50-year base case.

For short operating lives (i.e. the 15-year base case) when the value of remediated surface land is realised as a capital credit after the decommissioning period, for the aggregates operator, the value of this land will depend strongly on what the proposed after-use is, and to whom the land is sold. To investigate the range of potential outcomes, each of the after-uses presented in Table 5.6 were appraised based on the outcome that the aggregates operator will simply sell the land on to a 3rd party developer. This assumption depends on This assumption depends upon policies in the relevant development plan that would support possible future alternative uses, but is taken as appropriate here in order to simplify an already rather complicated valuation exercise. The range of options for after-use of the sub-surface space is reduced in comparison to the options available for the remediated surface land, but again for the purposes of simplicity in the valuation problem being tackled only, the benefits are assumed to be realised through the same mechanism: sale of the space on to a 3rd party developer at rates the same as those realised for the equivalent land use on surface.

Undoubtedly this is a simplification that potentially obfuscates many important planning and environmental control issues that made impede or prevent such a mechanism in practice. For example, potentially, there would be ongoing planning implications for visual impact arising from continued use of headgear for sub-surface access. In the case of a mine that required extensive dewatering during aggregates production, the costs of ongoing dewatering operations would become significant for after-use operations and thus may have an impact on the negotiated sale price. Such complicating issues, that are undoubtedly real, are not considered in the valuations presented subsequently – for simplicity. Any actual underground aggregates mining development proposal that was brought forward would have to consider such issues in detail on a case-by-case basis, and in all likelihood would involve an extensive stakeholder consultation and perception mapping exercise to determine acceptability rather than potential economic feasibility alone.

For longer operating lives (i.e. those evolving from the 50-year base case) when a concurrent surface use is entertained by the aggregates operator as the land owner of land outside the underground mine surface footprint, the aggregates operator may aspire to benefit from all the resulting rental for the land after it is developed and is being used. As noted above, in practice there is unlikely to be as much freedom over development of concurrent use of land as is implied here, because the issue would have to be debated in the process of any original grant of permission, and restrictions are likely to be the price of securing permission. In order to realise any potential economic benefit concurrent with aggregates extraction, there is a probable need for ownership for concurrent developments in order that any restrictions or obligations are allocated and properly discharged. Consequently, one outcome that may have to be entertained by the aggregates operator is that they may have to additionally adopt the role of Client for the concurrent development, in turn requiring additional commitment of capital, over and above that required to bring the aggregates mine to an operational state. Not all aggregates operators will be comfortable with this concept, but nevertheless the outcomes of such a policy are computed here, for completeness.

5.7 Assessment of after-use benefits.

The method of assessment of after-use benefits on the discounted cost of aggregate delivered was to first consolidate the range of after-uses on the basis of the values of land that may be realised for each after-use. This reduced the number of individual options that needed to be computed. Then for the underground aggregates mine that was most competitive, the Chitty prospect, every combination of like after-use for the underground space and like after-use of the remediated surface land was examined in turn and the valuation computations re-run. The results of this process are presented in Table 5.9. As noted above, these results are free from any costs associated with emergent planning issues or reconciling other stakeholder objections.

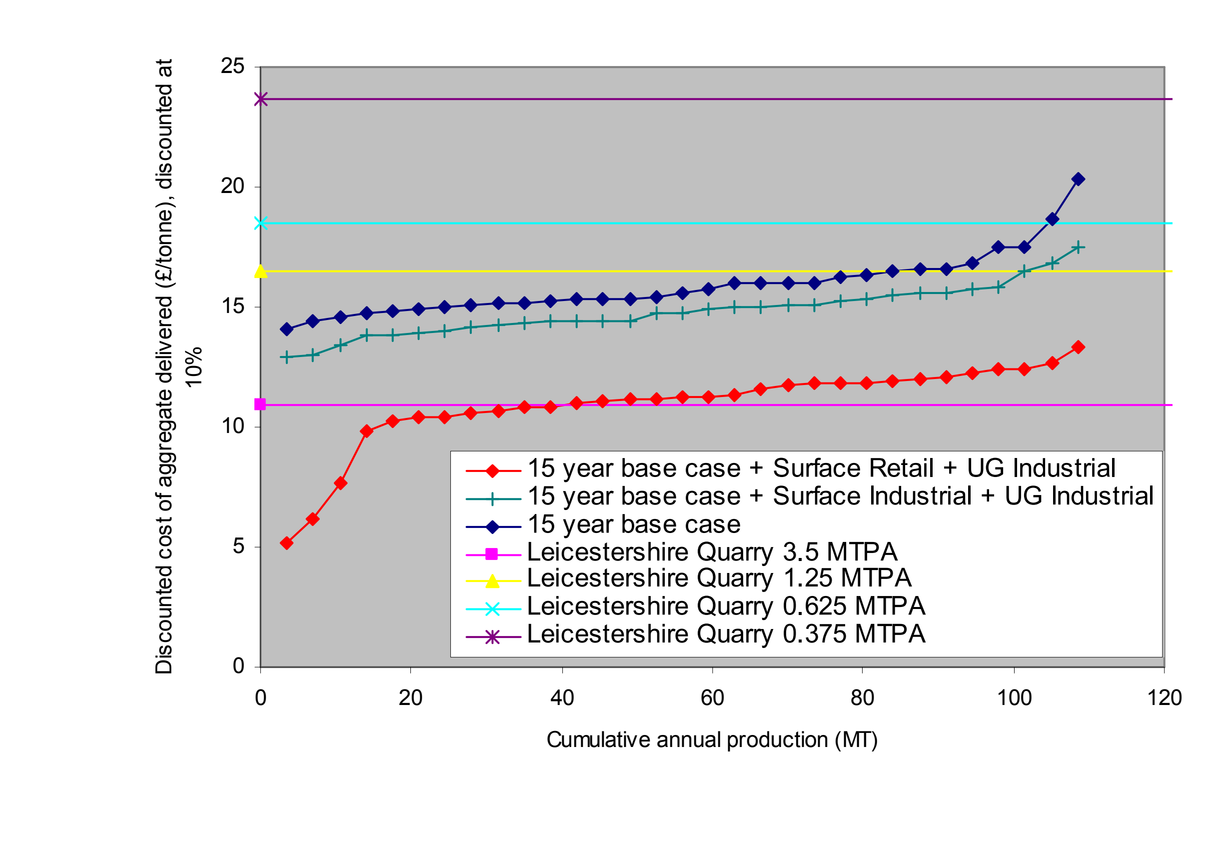


Figure 5.4: 15 year operating life capped underground aggregates prospect supply curves with optimistic and pessimistic after-use land use valuations. Relative DCAD(10%) values for the reference Leicestershire surface aggregates quarries are also indicated.

The results indicate that there is little incentive for underground aggregates operators to investigate after-use options for underground space or remediated land when agricultural land value rates are deemed applicable to the properties. For the Chitty prospect a minimum reduction in DCAD(10%) of 5% results when remediated surface land is sold after mine decommissioning at non-agricultural rates. Obtaining planning permission for residential use of remediated surface land reduces the DCAD(10%) by a minimum of 12%.

A pessimistic but pragmatic combination is probably remediated land sold for industrial use with underground space sold at industrial land use rates too, which leads to a reduction in the DCAD(10%) of ~7%. The rationale for this is that the land procured to develop the underground aggregates mines was formerly of agricultural class at the time it was procured. After aggregates production has ceased, the valuation models assume that the land has been decommissioned and remediated at the aggregates operator's cost, such that it can be sold for a subsequent industrial use. Upon being remediated, this same land at least benefits from being serviced with power, drainage, telecommunications, etc. as a result of the mine development activity that formerly took place upon it. The same can be considered for the underground space created. The space will benefit from power, drainage, telecommunications and ventilation services as a result of the mine development, and as such, industrial, serviced, land value rates are taken to be appropriate in determination of possible sale values credited in the valuation models.

The most optimistic practical combination is probably remediated land sold for a retail development on surface with underground space sold at industrial land use rates which leads to a reduction in DCAD(10%) of ~30%.

The effect of applying the pessimistic and optimistic after-use land use valuations on the sector as a whole is presented in Figure 5.4. The graph shows that under the optimistic scenario, 11 of the prospects would be able to compete with the Leicestershire SuperQuarry. Clearly, there may only be limited market capacity for retail park premises developed in former underground aggregates mines within the same area of South East area of England. However, as stated earlier in Section 5.1, only 4 such underground aggregates mines would need to be developed to displace crushed rock aggregate currently imported from the East Midlands and the South West regions. Mines at this scale will generate local transport issues. The precise extent of these issues in the regional context has not been explored as part of this study. On a regional scale, transport movements arising from aggregate imported from other regions should fall, whereas transport movements arising from indigenous production should rise. Any specific commercial proposal for development of an underground aggregates mine within the SE area of England brought forward for consideration of planning consent would have to conduct detailed traffic modelling studies, possibly at both local and regional scales, in order to quantify the net impacts or benefits that arise, in order that these can be assessed.

Table 5.9: Discounted cost of aggregates delivered for various after-uses of remediated surface land and underground space and change relative to the 15 year base case, for the Chitty prospect

Chitty — 15-year base case DCAD 14.05 £/tonne

DCAD(10%) £/tonne	Underground After-use		
Surface After-use	Agricultural, PFI - Sewage Treatment, PFI - Waste 2 Energy, PFI - Courts, PFI - Leisure Centre, PFI - Other, Biomass Plant	Industrial	PFI - Govt Office Refurb, Commercial
Agricultural, PFI - Sewage Treatment, PFI - Waste 2 Energy, PFI - Barracks, PFI - Courts, PFI - Leisure Centre, PFI - Other, Wind Farm, Biomass Plant	14.04	13.76	13.72
Industrial	13.32	13.04	13.00
PFI - Govt Office Refurb, Commercial	13.23	12.95	12.92
Residential - Small	12.13	11.85	11.82
Residential - Bulk	12.19	11.91	11.88
Retail	10.13	9.87	9.84

DCAD(10%) % change	Underground After-use		
Surface After-use	Agricultural, PFI - Sewage Treatment, PFI - Waste 2 Energy, PFI - Courts, PFI - Leisure Centre, PFI - Other, Biomass Plant	Industrial	PFI - Govt Office Refurb, Commercial
Agricultural, PFI - Sewage Treatment, PFI - Waste 2 Energy, PFI - Barracks, PFI - Courts, PFI - Leisure Centre, PFI - Other, Wind Farm, Biomass Plant	-0.07	-2.06	-2.35
Industrial	-5.2	-7.19	-7.47
PFI - Govt Office Refurb, Commercial	-5.83	-7.83	-8.04
Residential - Small	-13.67	-15.66	-15.87
Residential - Bulk	-12.19	-15.23	-15.44
Retail	-27.9	-29.75	-29.96

Note: Shaded areas indicate more probable combinations of surface and underground after uses.

Table 5.10: Top 10 underground mining of aggregate prospects under practical optimistic and pessimistic assumptions about after-uses of both remediated surface land and underground space.

Pessimistic (lower end use values)				Optimistic (higher end use values)			
Prospect	Prospect scale	Mine Life (years)	DCAD(10%) (£/tonne)	Prospect	Prospect scale	Mine Life (years)	DCAD(10%) (£/tonne)
Bletchley	Small	8	12.91	Bletchley	Small	8	5.17
Chitty	Very Large	15	13.04	Warkworth	Small	7	6.16
Bicester	Very Large	15	13.43	Ells Farm	Small	7	7.63
Fleet	Large	15	13.81	Chitty	Very Large	15	9.87
GST2	Medium	15	13.87	Bicester	Very Large	15	10.24
Stodmarsh	Very Large	15	13.88	Overthorpe Rd	Small	13	10.40
Sonning Eye	Very Large	15	14.03	Byfield	Small	10	10.41
Steeple Aston	Very Large	15	14.16	Fleet	Large	15	10.62
Bodicote	Large	15	14.29	Stodmarsh	Very Large	15	10.69
Akeman Street	Very Large	15	14.37	GST2	Medium	15	10.83

The top 10 prospect sites under the optimistic and pessimistic after-use assumptions on after-use are set out in Table 5.10 which ranks the Bletchley prospect first. This is interesting because the Bletchley prospect scale is identified as ‘small’ in Table 5.1 and its operating life is reported as 8 years in Table 5.4. This outcome highlights the possibility that in this instance, the underground crushed rock aggregates mining opportunity is of secondary economic importance relative to the surface and underground after uses, and could precipitate a realignment of focus of the design of the underground stoping layout for convenience in the after use phase, rather than for aggregate production operations. This message is reinforced with the further observation that for the pessimistic (and lower value) after use scenario, the prospect scale of Bletchley—only—is ‘small’ and the remaining prospects are predominantly very large. For the higher value after use scenario, the scale of five of the prospects (and the three highest ranking) is ‘small’ and each of these has a mine life less than the threshold 15 years.

5.8 Assessment of concurrent use benefits

The DCAD(10%) was recalculated considering each potential concurrent use in turn, for the Chitty prospect. This was the highest ranking prospect under the 50 year base case and was a prospect that yielded land available for development outside the underground mine surface footprint. Discounted cash flow models were established for the concurrent use project. The discounted cash flow model for the mine and the concurrent use were simultaneously optimised through a search for the break-even price of crushed rock aggregate when the discount rate was set at 10%. The scale of each concurrent development project, expressed in terms of the land area it would occupy, was allowed to vary, but was capped at the typical land take for such projects, present in the case studies. As a cash flow analysis was undertaken for the concurrent project, the values for the time to complete the development and the development project life were estimated, also based on the case studies reviewed.

Table 5.11: Effect of consideration of various concurrent uses for surface land procured by the aggregates operator where the aggregates operator is the primary investor in the development. (NPV = Net Present Value)

Chitty	50-year base case DCAD				13.03	£/tonne
Concurrent Use	Development Time (years)	Development Size (ha)	Project Life (years)	DCAD(10%) (£/tonne)	NPV(10%) Mine (£M)	NPV(10%) Concurrent Use (£M)
Agriculture	0	up to available area	20	13.02	-0.07	0.07
Residential - Small	2	1	20	13.03	-0.01	0.01
Residential - Bulk	2	10	20	15.2	44.23	-44.23
Industrial	2	10	20	13.5	9.73	-9.73
Commercial	2	5	20	15.62	52.89	-52.89
Retail	2	5	20	14.28	25.54	-25.54
PFI - Sewage Treatment	2	9	25	11.75	-25.89	25.89
PFI - Waste 2 Energy	2	4	25	14.37	27.34	-27.34
PFI - Barracks	2	5	50	12.79	-4.73	4.73
PFI - Courts	2	1	50	12.51	-10.50	10.50
PFI - Leisure Centre	2	2	50	13.11	1.78	-1.78
PFI - Govt Office Refurb	2	5	30	13.61	11.86	-11.86
Wind Farm	1	up to available area	25	13.08	1.10	-1.10
Biomass Plant	2	3	25	13.08	1.19	-1.19

The results of the analysis (Table 5.11) indicate that there are concurrent uses for available land procured by the aggregates operator that do lead to a reduced discounted cost of aggregate delivered, notably Sewage Treatment Plants (9.8% reduction in DCAD(10%)) and Prison Developments (47.0% reduction in DCAD(10%)). The big surprise in the positive results is the assessment for prison developments. Checks back to the raw PFI data used to compile Table 5.7 and Table 5.8 identified that the ratios of unitary charge to capital value for prison projects were substantially higher (at between 0.38 and 0.97) than for other PFI projects (typically between 0.10 and 0.25). It is important to note that these results do not reflect additional costs that may be incurred in pursuing efforts to obtain planning permissions for some of these concurrent uses.

Concurrent activities such as agricultural use and the development of low volume, low density, high value residential property also have a very small positive impact on the DCAD(10%).

There are also cases of after-use where the DCAD(10%) increases as a result of concurrent development activity. Large scale high density residential developments, other industrial, commercial and retail activities, public sector developments such as leisure centres and Government offices as well as wind farm and biomass renewable energy projects, all end up effectively being subsidised by the higher value of the DCAD(10%) determined for the aggregate. Of these, the wind farm development is a little surprising, but is primarily a result of the slightly low capacity factor used in the assessment of annual net income, however, the annual average wind speeds in the South East area of England area are lower than for many other parts of the UK.

The main indication offered in these data is that concurrent development activity should be appraised in detail and it should not be assumed that all concurrent activities will necessarily lead to reductions in the DCAD(10%), or, indeed, that such activities will secure planning consent. The essential reasons for the varying benefits of for each of the possible concurrent uses considered relate back to accepted yield (return) rates for developments of different types; such yield rates are embedded in the VOA data and the PFI data used to assemble Table 5.7 and Table 5.8. Another important dimension to this analysis to note is that the capital intensity for some of the development types is high and of an order that would out-weigh the capital intensity of the associated underground aggregates prospect development. Such circumstances are likely to be quite unattractive to aggregates operators.

6 Carbon Emissions

6.1 Carbon emissions from aggregate production operations

Computation of greenhouse gas emissions from both underground aggregates mines and quarry operations was undertaken in a two stage process.

- The total quantities of diesel fuel, electricity and ammonium nitrate and fuel oil (ANFO) explosives for each type of operation and for each scale of operation was established using the aggregate production models.
- The total quantities of diesel, electricity and ANFO were multiplied by the corresponding specific emissions factors.

For diesel and electricity, these were sourced from the 2009 Guidelines to DEFRA / DECC's Greenhouse Gas Conversion Factors for Company Reporting document (AEA, 2009). For ANFO, data used to establish the specific emissions factor for Ammonium Nitrate (NH_4NO_3) was sourced from Mortimer *et al.*, 2003. This study considered the emissions of NH_4NO_3 in detail as a result of its use as a fertiliser in the arable production of rape seed for biodiesel production. The figures presented by Mortimer *et al.* are for bagged ammonium nitrate fertiliser produced via ammonia and nitric acid from natural gas and delivered to the point of use; they consider CH_4 and NO_x (mainly N_2O) emissions explicitly and quantify the emissions in the NH_4NO_3 production process and feedstocks. The global warming potential (GWP) multipliers for CH_4 and N_2O used by Mortimer are not the same as are used in calculating the CO_2 equivalent emissions in the DEFRA/DECC guidelines, and the figures are reported in terms of the kg N_2 present in the NH_4NO_3 itself. Consequently, to return specific emissions factors in terms of kg $CO_{2,eq}$ / kg NH_4NO_3, a conversion factor of 1 kg $NH_4NO_3 \equiv 0.35$ kg N_2 was applied to Mortimer's figures. In addition, the GWP multipliers used to compute the total CO_2 equivalent emissions were the DEFRA/DECC values of 21 and 310 for CH_4 and N_2O respectively, rather than the 24.5 and the 320 used in the Mortimer study. ANFO mass totals were decomposed into NH_4NO_3 and fuel oil mass totals assuming the fuel oil component to be 6% - as for the mine and quarry models. Specific emissions factors for diesel were further assumed also to apply to the fuel oil component.

Table 6.1: Specific emissions factors used to determine the greenhouse gas emissions of aggregate production models.

Diesel			
	CO_2	2.6391	kg $CO_{2\,eq}$ / litre
	CH_4	0.0019	kg $CO_{2\,eq}$ / litre
	NO_x	0.0283	kg $CO_{2\,eq}$ / litre
	Total GHG	2.6694	kg $CO_{2\,eq}$ / litre
Electricity			
	CO_2	0.5430	kg $CO_{2\,eq}$ / kWh
	CH_4	0.0003	kg $CO_{2\,eq}$ / kWh
	NO_x	0.0034	kg $CO_{2\,eq}$ / kWh
	Total GHG	0.5467	kg $CO_{2\,eq}$ / kWh
ANFO			
	CO_2	0.6664	kg $CO_{2\,eq}$ / kg NH_4NO_3
	CH_4	0.0272	kg $CO_{2\,eq}$ / kg NH_4NO_3
	NO_x	1.5917	kg $CO_{2\,eq}$ / kg NH_4NO_3
	Total GHG	2.2853	kg $CO_{2\,eq}$ / kg NH_4NO_3

The results of the analysis of greenhouse gas emissions from the respective production models considered in this study are presented in Table 6.2 and show that specific emissions for aggregate production for the Reference Leicestershire SuperQuarry are 2.961 kg $CO_{2,eq}$ / tonne processed. For the scales of production realised identified as optimal for underground aggregates mines (14,000 tonnes/day), the CO_2 equivalent emissions for the underground mine with access by shaft and adit are 3.2 and 2.1 times those for the surface quarry, respectively.

Table 6.2: Calculation of greenhouse gas emissions for underground aggregates mine and quarry models considered in this study (PF = Powder Factor, Total GHG in kg $CO_{2,eq}$/tonne aggregate). Figures for underground aggregate mines are for shaft or adit depths of 150 metres.

		Diesel		Electricity		ANFO						Total Emissions	Ann. Prod.	GHG mined	GHG processed
Model	Tpd	Litre / yr	Total GHG	kWh / yr	Total GHG	tonne/yr ANFO	PF (kg/tonne)	AN- tonne/yr	Total GHG	-FO litre/yr	Total GHG	kg CO2eq/yr	Tonnes	kg CO2eq/tonne	kg CO2eq/tonne
Quarry	1,500	384,913	1,027,487	557,037	304,515	56	0.150	53	120,835	4,047	10,802	1,463,638	375,000	3.9030	9.187
no strip	2,500	721,521	1,926,027	676,800	369,986	94	0.150	88	201,391	6,744	18,003	2,515,408	625,000	4.0247	7.205
	5,000	1,605,272	4,285,112	752,001	411,096	188	0.150	176	402,782	13,489	36,005	5,134,996	1,250,000	4.1080	6.522
	14,000	1,880,897	5,020,865	1,448,298	791,741	525	0.150	494	1,127,791	37,768	100,815	7,041,212	3,500,000	2.0118	3.162
Quarry	1,500	521,514	1,392,130	557,037	304,515	56	0.150	53	120,835	4,047	10,802	1,828,282	375,000	4.8754	10.160
1,5 m strip	2,500	969,717	2,588,563	676,800	369,986	94	0.150	88	201,391	6,744	18,003	3,177,943	625,000	5.0847	8.265
	5,000	1,791,511	4,782,261	752,001	411,096	188	0.150	176	402,782	13,489	36,005	5,632,145	1,250,000	4.5057	6.920
	14,000	2,071,791	5,530,438	1,448,298	791,741	525	0.150	494	1,127,791	37,768	100,815	7,550,785	3,500,000	2.1574	3.308
Quarry	1,500	553,742	1,478,159	557,037	304,515	56	0.150	53	120,835	4,047	10,802	1,914,311	375,000	5.1048	10.389
3 m strip	2,500	1,035,946	2,765,355	676,800	369,986	94	0.150	88	201,391	6,744	18,003	3,354,736	625,000	5.3676	8.548
	5,000	1,824,815	4,871,161	752,001	411,096	188	0.150	176	402,782	13,489	36,005	5,721,045	1,250,000	4.5768	6.991
	14,000	2,109,748	5,631,762	1,448,298	791,741	525	0.150	494	1,127,791	37,768	100,815	7,652,108	3,500,000	2.1863	3.337
R&P	1,500	394,123	1,052,073	3,412,576	1,865,553	324	0.865	305	696,781	23,334	62,286	3,676,694	375,000	9.8045	15.089
Adit	2,500	714,264	1,906,655	6,413,594	3,506,119	568	0.908	534	1,219,367	40,835	109,001	6,741,143	625,000	10.7858	13.967
	5,000	888,557	2,371,914	11,143,512	6,091,824	1,135	0.908	1,067	2,438,734	81,670	218,003	11,120,475	1,250,000	8.8964	11.311
	14,000	1,605,798	4,286,517	13,534,974	7,399,164	3,027	0.865	2,846	6,503,292	217,788	581,340	18,770,313	3,500,000	5.3629	6.513
R&P	1,500	426,717	1,139,079	4,693,761	2,565,938	324	0.865	305	696,781	23,334	62,286	4,464,085	375,000	11.9042	17.189
Shaft	2,500	623,443	1,664,219	8,862,779	4,845,015	568	0.908	534	1,219,367	40,835	109,001	7,837,603	625,000	12.5402	15.721
	5,000	968,977	2,586,588	17,660,795	9,654,627	1,135	0.908	1,067	2,438,734	81,670	218,003	14,897,952	1,250,000	11.9184	14.333
	14,000	1,942,677	5,185,783	35,235,219	19,262,037	3,027	0.865	2,846	6,503,292	217,788	581,340	31,532,452	3,500,000	9.0093	10.160
LH	1,500	651,334	1,738,672	3,413,397	1,866,002	630	1.679	592	1,352,493	45,293	120,902	5,078,068	375,000	13.5415	18.826
Adit	2,500	1,745,915	4,660,546	6,414,939	3,506,855	672	1.075	631	1,442,951	48,323	128,988	9,739,340	625,000	15.5829	18.764
	5,000	2,369,015	6,323,849	11,146,035	6,093,203	1,795	1.436	1,687	3,854,967	129,098	344,602	16,616,621	1,250,000	13.2933	15.707
	14,000	3,260,975	8,704,847	13,538,632	7,401,164	2,560	0.731	2,407	5,499,735	184,180	491,631	22,097,377	3,500,000	6.3135	7.464
LH	1,500	807,284	2,154,965	6,944,124	3,796,144	630	1.679	592	1,352,493	45,293	120,902	7,424,504	375,000	19.7987	25.083
Shaft	2,500	1,594,906	4,257,442	7,528,124	4,115,400	672	1.075	631	1,442,951	48,323	128,988	9,944,781	625,000	15.9116	19.092
	5,000	2,752,325	7,347,058	14,033,317	7,671,594	1,795	1.436	1,687	3,854,967	129,098	344,602	19,218,220	1,250,000	15.3746	17.789
	14,000	3,769,973	10,063,565	23,738,877	12,977,332	2,560	0.731	2,407	5,499,735	184,180	491,631	29,032,263	3,500,000	8.2949	9.445
Process	1,500	37,740	100,744	3,440,659	1,880,905	NA	NA	NA	NA	NA	NA	1,981,649	375,000	5.28440	NA
	2,500	40,101	107,045	3,440,659	1,880,905	NA	NA	NA	NA	NA	NA	1,987,950	625,000	3.18072	NA
	5,000	66,442	177,361	5,195,664	2,840,314	NA	NA	NA	NA	NA	NA	3,017,675	1,250,000	2.41414	NA
	14,000	95,145	253,979	6,901,453	3,772,817	NA	NA	NA	NA	NA	NA	4,026,796	3,500,000	1.15051	NA

Table 6.3: Percentage consumption of electricity for a 14,000 tonnes per day aggregates quarry or underground aggregates mine (excluding process plant consumption). Hoisting figures relate to the winder for the mines accessed by shaft and to the belt conveyor for mines accessed by a decline adit, for a depth of 150m.

14,000 tpd	Quarry			Room & pillar wet		Room & pillar dry	
Electricity	no strip	1.5 m strip	3 m strip	shaft	adit	shaft	adit
Pumping	4%	4%	4%	19%	27%	11%	16%
Ventilation	0%	0%	0%	41%	57%	45%	67%
Crushing	96%	96%	96%	4%	5%	4%	6%
Hoisting	0%	0%	0%	36%	10%	40%	11%
Total	100%	100%	100%	100%	100%	100%	100%

Table 6.4: Percentage consumption of diesel for a 14,000 tonnes per day aggregates quarry or underground aggregates mine using the room-and-pillar mining method (excluding diesel used in explosives and use around the process plant)

14,000 tpd	Quarry			Room & pillar wet		Room & pillar dry	
Diesel	no strip	1.5 m strip	3 m strip	shaft	adit	shaft	adit
Loading	37%	33%	33%	22%	27%	22%	27%
Hauling	39%	35%	35%	68%	59%	68%	59%
Stripping	0%	7%	8%	0%	0%	0%	0%
Services	24%	25%	24%	10%	15%	10%	15%
Total	100%	100%	100%	100%	100%	100%	100%

Table 6.2 clearly shows that electricity consumption is significantly greater for underground aggregates production in comparison to surface quarrying (for the same production rate). Table 6.3 confirms that this is due to ventilation fan operation and, to a lesser extent, dewatering pump operation. Electricity load for aggregate production from surface quarries is confined to that from the primary crushing unit only, with the remainder used by the processing plant (included elsewhere). Primary crushing is not considered part of the processing plant, mainly for compatibility with the underground mines as the latter need to crush rock underground in order for it to be conveyed up a decline or hoisted up a shaft. Table 6.2 shows that diesel consumption rates are comparable between quarrying and underground aggregates mining and that the consumption of explosives is substantially higher for underground mines where there is far greater confinement of the rock to be blasted.

Mines with adit access use mobile plant that is primarily designed for surface mining use which is generally cheaper and has better fuel efficiency; whereas the shaft access mines use mobile plant specifically designed for underground use which that is typically more expensive and has higher fuel consumption. This is mainly why diesel fuel consumption is higher for shaft access mines than adit access mines (Table 6.4).

Table 6.2 to Table 6.4 have been formulated assuming a mine shaft or adit depth of 150m. The specific carbon emissions associated with each of the underground aggregates prospects considered in this study have been computed and are presented in Table 5.3. As most of the prospects are deeper than 150m, electricity consumption due to hoisting and pumping will increase due to greater haul height and pump head. However, the specific carbon emissions do not increase linearly with depth because the pressure drops (and hence fan work) in the mine ventilation circuit are primarily due to the underground workings, not the shaft lengths.

6.2 Carbon emissions associated with transport

Estimation of carbon emissions associated with distribution of aggregate from quarries was based on Department of Transport data (Coyle, 2007) on the fuel consumption data of articulated trucks and rigid bodied trucks presented in Figure *3.8*. The types of trucks assumed used in this study were rigid bodied trucks with a maximum payload of 20 tonnes (the 32 tonne curve in Figure *3.8*) and articulated trucks with a maximum payload of 28 tonnes (the 44 tonne curve in Figure *3.8*).

Total $CO_{2,eq}$ emissions where then determined for various haulage distances by multiplying the DEFRA/DECC recommended (AEA, 2009) specific emissions factor for diesel used as road fuel in freight haulage internal combustion engines (2.6694 kg $CO_{2,eq}$ / litre diesel) by fuel consumed over the haulage distance. A decision was taken not to use the DEFRA/DECC kg $CO_{2,eq}$ / tonne km data because of ambiguities on payloads that may have been incompatible with the aggregate distribution model assumed. Outbound journeys assumed that trucks were loaded to their maximum payload capacity. Rigid bodied trucks were assumed empty during their inbound journey; articulated trucks were assumed to have a return payload for haulage distances over 50 miles, assumed 50% loaded (on average) for haul distances of 40 to 50 miles and assumed to return empty for haulage distances less than 30 miles. The total $CO_{2,eq}$ emissions were then normalised by the maximum payload capacity to produce figures of $CO_{2,eq}$ / tonne.

Rail freight was also considered and the DEFRA/DECC (AEA, 2009) figure of 0.03190 kg $CO_{2,eq}$ / tonne km was used in a product with the distance of the prospect from the market area in km, to establish a figure for the kg $CO_{2,eq}$ / tonne.

The weighted average $CO_{2,eq}$ emissions for aggregate delivery for specific prospects were then computed using weights that reflect the proportion of product distributed by the three modes of rail, rigid bodied trucks and articulated trucks. If the aggregate producer had a production intensity of 5,000 tonnes per day or greater and was located within 2km of a railway line, it was assumed that a rail head would be commissioned and that 50% of aggregate product would be distributed using this mode of transport, with 30% and 20% being allocated to the articulated trucks and rigid bodied trucks respectively. If an aggregates producer did not have access to rail freight facilities (by being either too far from a railway line or too small to warrant constructing one) 50% of production was assumed distributed by articulated truck and 50% by rigid bodied truck operating on a short transport radius. It should be noted that rail movement from major new production units in the greater SE area of England assumes freight paths would be available on the network and this is already proving problematic for surface operators.

6.3 Net carbon emissions

Under the set of assumptions set out in section 6.2, the Reference Leicestershire SuperQuarry at 68 miles from the M25 peripheral road has 6.12 kg $CO_{2,eq}$ / tonne hauled. Adding this to the carbon emissions for production and processing (section 6.1) produces a total specific carbon emissions of 3.16 + 6.12 = 9.28 kg $CO_{2,eq}$ / tonne delivered.

Two counter-examples are presented to illustrate the relative carbon emissions from the underground operations. The Bletchley prospect is identified as a 14,000 tonnes per day room-and-pillar mine with underground access by adit, located 31 miles from the M25 peripheral road.

Emissions from production and processing:	6.51 kg $CO_{2,eq}$ / tonne produced and processed
Emissions from aggregate delivery:	2.80 kg $CO_{2,eq}$ / tonne hauled
Total carbon emissions	9.31 kg $CO_{2,eq}$ / tonne delivered
Emissions relative to Reference Leicestershire SuperQuarry	1.00 (2DP)

The Chitty prospect is identified as a 14,000 tonnes per day room-and-pillar mine with underground access by shaft, 45 miles from the M25 peripheral road.

Emissions from production and processing:	10.16 kg $CO_{2,eq}$ / tonne produced and processed
Emissions from aggregate delivery:	4.09 kg $CO_{2,eq}$ / tonne hauled
Total carbon emissions	14.25 kg $CO_{2,eq}$ / tonne delivered
Emissions relative to Reference Leicestershire SuperQuarry	1.54

Of the two counter-examples, Table 5.3 shows that Chitty is more typical of prospects that are likely to be developed as underground aggregates mines in the South East area of England. Consequently, it can be concluded that the underground mines are unlikely to compare favourably with the surface quarrying operations on the basis of $CO_{2,eq}$ / tonne delivered, despite their much closer distance to market. The reason for this is because the underground mines need to run ventilation fans virtually continuously.

7 Principal Conclusions

Two distinct approaches to exploitation of underground aggregates have been identified within the results presented in this work. The first is a long term production life approach that naturally assimilates economic benefits associated with the aggregates operation engaging in a concurrent development use of land procured above the mine workings. The second is a short term production life approach that naturally assimilates economic benefit from the sale of the remediated land in the surface footprint of the underground mine (after the decommissioning and remediation) and economic benefit from the sale of the underground space created during aggregate extraction.

The 50-year base case chart demonstrates that underground aggregates mines, within or close to the market demand centre, have costs that lie higher than those of the Reference Leicestershire SuperQuarry which has a DCAD(10%) of £10.95/tonne and lower than those of a Leicestershire Quarry delivering crushed rock aggregate at a rate of 1.25 MTPA with a DCAD(10%) of £16.48. Despite this, these underground quarries should be able to provide for a substantial share of the indigenous South East of England area market for crushed rock aggregates.

The prospect exploitation optimisation process converged on room-and-pillar mine designs operating at a scale of 3.5 million tonnes per annum. The 2005 crushed rock aggregate market volume for the South East of England area indicates that there may be room for four underground aggregate mines operating at this scale. The local transport aspects of four operating mines at this scale on the local and trunk road networks, and the rail network, set within a regional scale context, needs further study.

Minimum 35% higher capital intensity for development of an underground aggregates mine in comparison to that for the surface option could represent a disincentive for aggregates operators investing in new underground aggregates production capacity, unless new non-cost pressures (such as planning policy) meant that new surface quarrying capacity became unavailable as an option.

The effect of not securing the freehold of the land within which the aggregates will be exploited is to cause a rise in the DCAD(10%) for all prospects; in the valuation calculations, the increase in input costs is not compensated by the reduction in total capital expenditure. This result implies that it will be more cost effective for underground aggregate mining operations to secure freehold rather than securing mineral rights only, and paying royalty.

Valuation benefits of after-uses of both remediated surface land and underground space are only material to relatively short term production plans that may not exploit the full extent of any prospect. Possible after-uses need further study for their public acceptability, their impacts, the likelihood of them triggering restrictions attached to original mining permissions, and the prospects of them ever securing permission.

Modestly optimistic assumptions regarding after-use types for remediated surface land and underground space do bring about reductions in the discounted cost of aggregate delivered for underground aggregates mines that have a relatively short operating life, such that these operations should be able to readily compete with SuperQuarries located in the East Midlands and the South West regions of England.

Valuation benefits of concurrent uses of land held by the aggregates operator outside the underground mine surface footprint are only material to relatively long term production plans that mine under land outside the area envelope defining the surface footprint of the underground mine. Shorter term production plans have production faces that do not make it as far as this envelope.

Certain development types undertaken by the aggregates operator concurrent with the underground aggregates mine development, on surface land procured by the aggregates operator, outside the surface footprint of the underground mine do bring about reductions in the discounted cost of aggregate delivered for underground aggregates mines that have a relatively long operating life. A notable example includes Sewage Treatment Works, which would definitely allow these production units to compete with SuperQuarries exporting to the South East area of England. Despite the positive economic outcome, it should be noted that this lies among those types of development that are most likely to trigger adverse public reaction, not just at the point of consenting after uses, but also at the point of consenting the mine proposal itself.

Concurrent activities such as these would require the aggregates operator to engage in, and commit capital resource to, potentially non-core business activity, and as such, may only be of interest to large, vertically integrated players in the aggregates business that have the resources, expertise and appetite to engage in such activities.

Underground mines are unlikely to compare favourably with the surface quarrying operations on the basis of $CO_{2,eq}$ / tonne delivered, despite their much closer distance to market. The reason for this is because the underground mines need to run ventilation fans virtually continuously.

8 Recommendations

8.1 Recommendations for policy development and consultative activities

8.1.1 Appraise policy incentives for underground aggregates mining.

The principal conclusion of the current research is that underground crushed rock aggregate mines located within the South East area of England may be able to compete for a share in the overall crushed rock aggregates market by replacing / displacing aggregate imported from quarries with production rates ~1.25 MTPA in Leicestershire and Somerset, but may find it more of a challenge to compete with large quarries producing ~3.5 MTPA in the same areas. Lower discounted costs of aggregates delivered have been identified for the underground option, which bring them into direct competition with ~3.5 MTPA surface quarries on cost, however these involved relatively short production lives and concurrent developments which add complexity to projects, and hence add to project risk. Concurrent uses aside, in general, a decision to exploit underground aggregates resources can be subject to greater risk than a surface operation; surface resource estimates clearly benefit from higher confidence due to greater ease of access to the aggregate body for mapping, sampling and characterisation, prior to development. Aggregates operators considering 'green field' increases in capacity may be disincentivised by the higher capital intensity of the underground options, irrespective of the parity or near parity of the economic case on cost. For these reasons it is a recommendation of this work that policy incentives or initiatives be investigated that aim to compensate for this disincentive and the potentially enhanced risk. Example incentives or initiatives to be investigated could include:

- (partial) exemption from the Aggregates Levy,
- identification (by minerals planning authorities) of prospect areas that will be favourably considered for exploitation by underground mining methods,
- taxation incentives, such as accelerated capital allowances, and;
- establishment of a floor-price for aggregates sourced from underground mines, possibly financed by the Aggregates Levy.
- conduct an industry-wide consultation on findings from the current research.
- conduct further work considering the planning context in which mining proposals in the SE area of England, and additionally to engage in stakeholder perception activities to assess concerns of the public about underground mining operations, and potential after-uses.

While the detailed interactions between the research partners and the industry partner in this project enabled the input production, transportation, environmental mitigation, decommissioning and after care costs used in economic appraisals to be as realistic as possible, as part of further study, comments from the aggregates industry as a whole should be sought on the research findings. Specific topics for inquiry may include:

- determination of the appetite for engagement within concurrent, non-core-business, developments on the surface above underground aggregates operations,
- the extent to which the likely increased capital intensity of underground aggregates operations would act as a disincentive to their development as the aggregates market evolves and as currently permitted surface quarrying operations reach their ultimate pit limits, and;
- industry perception of the relative technical, commercial, and planning risk associated with underground mining of aggregate.
- Obtain public and stakeholder opinion on new uses for former mine surface areas and underground space. This must include discussion with the mineral planning authorities in the SE and EE regions.

A broad range of end use types for underground void created by aggregates mining were considered in the current research. In the first instances, it seems likely that the main type of use will be storage applications, particularly storage where the equivalent space on surface has relatively low fit-out cost and relatively high operating cost, for example, refrigerated warehousing. Some after uses that seem less likely for early adoption involve mass occupancy, such as shopping centres or work spaces. In these cases it will be important to establish the extent of collective acceptance of these after uses by the public generally and key stakeholders such as employers, in order to determine the potential demand for underground space used in this way. Human perception of long term occupancy of the sub-surface is important in this regard because many people suffer apprehension and anxiety when having to use even a subway or an underground car park and although many workers appear to prefer the underground atmosphere, some people suffer from claustrophobia and others have a psychological fear of going underground. At the same time as this core study is undertaken, it would be useful also to investigate public and specific stakeholder opinion on potentially emotive non-storage after uses such as: waste management activity, sewage works, and cemeteries. Other potentially controversial after uses for which public opinion should be gauged (particularly if underground facilities are to be located close to significant urban populations) are energy storage applications (hydrocarbon gas and liquid storage, compressed air storage) and the installation of large scale generation plant in the sub-surface.

8.2 Recommendations on technical aspects

8.2.1 Conduct research to reducing the energy intensity of mine services

The production cost models developed in this research have indicated that for deep mines electricity consumed in ventilating the mine can be as much as 67% of the total electricity consumed. Research that is successful in reducing the energy consumption associated with mine ventilation will be of value to the minerals sector as a whole and is thus a recommended priority for investigation. Savings in ventilating energy could lead to significant reductions in operating cost as well as significant reductions in carbon emissions. Other areas of mining operations worthy of further research in energy and carbon auditing are pumping and hoisting which also consume significant proportions of the total electrical energy used.

8.2.2 Develop a deep level aggregates-specific drilling campaign

While the BGS data base of boreholes has extensive coverage throughout the South East area of England, the number of entries in this data base comprising bore holes that are sufficiently deep to penetrate the deep-level geology hosting potential aggregates resources is insufficient to quantify resource estimates. It is recommended that a further more detailed study be undertaken to identify the locations within the South East area of England that would maximise information obtained in core from new boreholes sunk as part of a deep level aggregates specific drilling campaign. Such a campaign would also aim to establish prospect aggregate quality with greater confidence; investigation of the correlation of geophysical measurements, such as sonic velocity, with aggregate properties, such as aggregate abrasion value. To achieve this, the drilling campaign should to be augmented with geophysical observations in the proximity of the new holes and laboratory testing of aggregate qualities undertaken on samples from the bore holes. These investigations would permit the existing body of geophysical data to be interpreted in a new manner that may lead to identification of specialist or niche, and thus higher value, aggregates that would be definitely worth extracting using underground mining methods. Depending on the circumstances, exploratory drilling may not require planning permission (part 22, Schedule 2, General Permitted Development Order 1995, normally subject to giving the mineral planning authority 28 days notice, which allows for the possibility of the permitted right being withdrawn, and the requirement for planning permission to be reinstated). This would be a good litmus test of likely public and local authority reaction to possible underground aggregates mining, facilitated by a full stakeholder engagement program.

8.2.3 Investigate underground aggregates mines developed from existing surface quarries.

The research reported considered the relative feasibility of surface quarries located in the main crushed rock aggregate producing areas and underground aggregates mines located in the South East area of England, to establish whether the latter could compete with the former. When the existing quarrying operations located in the currently exporting counties of Somerset and Leicestershire reach their ultimate pit limit, one option for such operations is to extend workings underground. According to the results presented in the current work, in such instances, the cash operating costs of stone production of the existing aggregates producers could increase from approximately £1.00/tonne (applicable to the reference Leicestershire SuperQuarry) to approximately £2.40 /tonne (applicable to the 3.5 MTPA, 150m deep room-and-pillar mine). Relative capital expenditures are ignored in this observation, but capital expenditures for the quarry-to-underground option, although lower than for a ‘green-field’ underground mine, may still be sufficient to favour underground aggregates mines located in the South East area of England. Consequently it is believed that this topic would be worthy of further investigation.

8.2.4 Investigate underground aggregates as co-products of industrial minerals mining.

The focus of the current research was the production of crushed rock aggregates at depth using underground mining methods; industrial minerals were not a principal concern. Consequently, as an extension of the current research, it is recommended that the BGS geological database is revisited to determine whether or not industrial minerals targets are intersected in boreholes where potential aggregates prospects have also been identified. In such cases, the primary access infrastructure (the shafts or adits) may also provide access for the exploitation of industrial minerals as well as crushed rock aggregate. The aggregates and the industrial minerals would then become co-products for a single site operators or a joint venture initiative; enhanced revenue may be realised for broadly the same amount of capital investment in mine development. This would require great care in wording of planning application and the permissions to cover all target materials.

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ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix A

Costs of Environmental Mitigation
Costs of Decommissioning & Aftercare
Health & Safety Costs

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Contents

Tables

A 1 Costs of environmental mitigation

It has been suggested that there may be environmental and social benefits associated with reduced noise, dust, vibration and visual intrusion of underground aggregates mines compared with surface quarries. The generally accepted environmental impacts of surface quarrying are given in Table A 1.1, together with additional comments relating to whether these are likely to increase or decrease with underground aggregates mining, and examples of possible mitigation measures. An attempt to outline 'typical' or 'possible' costs associated with these items is set out in Table A 1.3 and Table A 1.4.

However, when developing these cost estimates it quickly became apparent that 'generic' cost models are almost impossible to obtain because each individual location will have a unique set of circumstances, resulting in a particular set of environmental impacts and consequently a combination of costs which are very site specific. Some environmental mitigation costs will vary in proportion to the size of the operation (whether surface or underground), while others are unrelated to this aspect. Other costs will depend on geology (type and depth of target rock), location of nearby residences, quality of local infrastructure, pre-existing environmental conditions (including topography, landscape appearance, the presence or absence of particular flora and fauna) and many other factors.

In reality any potential underground mine would have to be subjected to a detailed feasibility study which would include an Environmental Impact Assessment (EIA) and a comprehensive examination of environmental costs; both of which would be specifically tailored to the individual site and circumstances involved.

Moreover, many of the costs identified in this research would occur with both a surface and underground operation and consequently for the purposes of this research they effectively cancel each other out. The overall aim of this study is to identify the cost differential between the two methods of working, however, in order to reach this differential it has been necessary to attempt an itemisation of the costs incurred in order to more easily identify where variances occur.

This research is specifically looking at the feasibility of a new 'green-field' location and not the option of developing underground from an existing surface quarry. In many cases the latter is more likely to be economic because the site infrastructure, including all appropriate environmental mitigation measures, will already be in place. In such a circumstance, additional environmental costs may be lower.

A 1.1 Environmental Impacts

Environmental impacts "are the changes to the environment that result from a project or activity. These impacts could be positive, negative, temporary or permanent and may be different in normal, abnormal or emergency conditions" (Smith and Watkins, 2007). They will also vary depending on the different phases of extraction, for example site investigation, construction of the site, extraction, closure, restoration and after-use. The cost model developed under this part of the research is looking at environmental mitigation measures during aggregates extraction. Table A 1.1 contains the types of environmental impact which are associated with surface quarrying, comments relating to whether these are likely to increase or decrease with underground mining, and examples of possible mitigation measures (note: this table is not intended to be an exhaustive list and specific sites may have other impacts not mentioned).

The cost model developed for this research is based entirely on the costs associated with mitigation measures for the various environmental impacts. The model does not take any account of the perception of local residents of these possible impacts, nor their "willingness to pay" to remove or defend against such impacts.

Table A 1.1: Typical environmental impacts for surface quarrying, differences expected with underground mining for aggregates and typical mitigation measures

Cate-gory	Impact for Surface Quarries	Comparison of Impact for Underground Mines	Example of Mitigation Measures
Air emissions	Dust from blasting	Will be contained but will still need to be controlled for health and safety purposes	Water suppression
	Dust from vehicle wheels and unsealed road surfaces	Less unsealed roads at surface therefore reduced, but still need to be controlled underground	Wheel wash for vehicles leaving the site, use of a road sweeper, water suppression
	Dust from processing plant	Will be the same because the processing plant is assumed to be on the surface. May be slightly less as primary crusher needs to be located in the subsurface.	Enclosure around plant
Noise Pollution	Noise from excavation area	Will be contained underground and therefore much reduced	Screening bunds or fences, acoustic enclosures on machinery, maintenance
	Noise from loading and hauling	Mostly contained underground and therefore much reduced	Screening bunds or fences, using conveyors instead of dumptrucks, rubber lining equipment
	Noise from processing plant	Will be the same because the processing plant is assumed to be on the surface. May be reduced as primary crusher needs to be located in the sub-surface.	Enclosure around plant, rubber lining of transfer chutes, type of screen mats
Land	Contamination of land from chemical, fuel or oil spillages	Will be the same even if the storage facilities are underground	Containment bunds or double-skinned storage tanks, secondary containment systems if appropriate
	Damage to soil through inappropriate handling	Much reduced as soil will only be removed from the area of the processing plant	Soil handling plan and industry-wide accepted procedures
Waste	Non-mineral wastes such as used machinery parts, wastes from canteens and offices	Will be the same	Collection and licensed disposal, regular Local Authority collections
Water	Increased levels of silt-laden run-off with possible sedimentation of water courses	Reduced because the only run-off is from the processing plant area	Water management system possibly including settlement lagoons or silt traps
	Alteration of water table and modification to water flows	Could be increased, or similar	Licensed abstraction, transfer and discharge, monitoring
	Sewage from washroom facilities	Will be the same	Connection to main sewers or cess pit
Traffic	Internal traffic movements generating noise	Likely to be reduced as part will be contained	Maintenance of vehicles and internal roads
	External traffic causing congestion at entrance	Will be the same	Bellmouth, ghost island and possible road widening.
	External traffic causing additional noise	At regional scales, likely to be the same (off-site) for same aggregate volumes transported. Locally, in the SE area of England may be potentially increased	Maintenance of vehicles, opening hours of site. New or improved local access roads and junctions to access the principal road network.

continued from previous page

Cate-gory	Impact for Surface Quarries	Comparison of Impact for Underground Mines	Example of Mitigation Measures
Visual Intrusion	Change in scenic quality of the area	Overall may be reduced as extraction area is contained underground, however mitigation will be needed for the processing plant Prominent mine headgear may introduce visual impact not present with surface quarries. Smaller scale winding equipment may be suitable for specific after-uses.	Erection and maintenance of screening bunds, fences and trees
Bio-diversity	Disturbance to protected species	Likely to be reduced as surface disturbance is limited to the processing plant area. Disturbance arising from surface stockpiles, waste piles and load out areas including rail sidings likely to be similar for similar production intensities.	Accommodation of species elsewhere on site or on non-operational land

A 1.2 Assumptions made during environmental cost modelling

Due to the wide range of variables that have a bearing on the size, and therefore cost, of mitigation measures, a number of assumptions have had to be made regarding the scale and nature of the aggregates extraction operation (both for surface and underground sites). A number of these were taken from the assumptions made for the engineering cost modelling exercise, and these are outlined as follows:

- The capital costs for equipment includes a water truck for dust suppression (an environmental mitigation measure) and therefore this is not duplicated here. It is assumed that the operational cost of this water truck is included in the engineering cost model.
- It is assumed that the extraction site is working limestone, which has a bearing particularly in terms of water management.
- There are four different production scales, in terms of tonnages extracted, and associated requirements, as outlined in Table A 1.2. This has implications in terms of 'land take' for surface quarrying. An underground aggregates mine would require less 'land take' and certain environmental costs would be reduced as a result.
- The assumptions for the processing plant include that it is located in "large, shed-like buildings", which means that no allowance has been made here for enclosure of the processing plant to reduce dust emissions and noise.
- The assumptions also include reference to stockpiles of finer material being under cover. Consequently, no cost has been allowed here for dust suppression of this finer material.

Table A 1.2: Relevant site specific assumptions made depending on size of operation

	Site 1	Site 2	Site 3	Site 4
Tonnes per day	1500	2500	5000	14000
Tonnes per annum	375,000	625,000	1,250,000	3,500,000
Ultimate surface area (hectares)	25	50	100	100
Pre-strip surface area (hectares)	13	25	50	50
Life of site (years)	20	20	20	20
Reserve (million tonnes)	7.5	12.5	25	70
Number of dump trucks required	2	5	6	7

A 1.3 Compliance with Environmental Legislation

Compliance with environmental legislation is a legal requirement. Failure to comply can result in prosecution along with financial penalties. Many companies have an Environmental Management System (EMS) to help them ensure compliance with the law. An EMS is a systematic way of ensuring the business activities are compliant and keep up to date with evolving legislation. Lists of environmental legislation relevant to quarrying are well documented (see Pocket Guide to Environmental Legislation (England and Wales) 2005) or www.goodquarry.com. NetRegs is a partnership between the UK environmental regulators – the Environment Agency in England and Wales, the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA). They provide free environmental guidance for small and medium-sized businesses throughout the UK (see www.NetRegs.gov.uk).

For any new 'green-field' extraction site (whether at surface or underground), it would be necessary for someone to establish what pieces of legislation need to be complied with and this would take time and therefore cost money. For the purposes of this research, it has been assumed that the operator concerned already has an EMS and a methodology in place for ensuring compliance with all the relevant legislation. The individual items identified in the documentation mentioned above have been included in the items at Table A 1.1 and the cost estimations in Table A 1.3 and Table A 1.4.

Table A 1.3: Cost estimates of environmental mitigation for surface quarries

Surface Quarry		**Production levels**			
CSM Assumptions	Tonnes per day	1,500	2,500	5,000	14,000
	Tonnes per annum	375,000	625,000	1,250,000	3,500,000
	Site life (years)	20	20	20	20
	Ultimate surface area (hectares)	25	50	100	100
	Pre-strip surface area (hectares)	13	25	50	50

Mitigation of Environmental Impacts		**Typical Costs £** (see notes)				Additional notes (surface quarry)
Impact	**Mitigation (examples)**					
Dust	Installing / maintaining a wheel wash	80,000	80,000	80,000	80,000	It is assumed this is a requirement on the planning permission; if not, then it is likely that it would not be installed.
Dust	Use of a road sweeper	4,160	8,320	16,640	24,440	Small site: sweeper hire (with driver) @ £20 per hour, 2 hours per visit, once per week if dry, 3 times if wet (ave 2 times per week). Large site: self drive sweeper @ £470 per week. Assume medium sites are similar to small site but more hours per visit
Dust	Suppression using water	Already included in production cost models				Capital cost of water bowser included in engineering cost models, assume operating costs are also included.
Dust/noise	Enclosure around fixed plant	Already included in production cost models				Assume this is included in the costs of establishing a fixed plant.
Noise	Extra cost of rubber lining equipment	50,000	95,000	110,000	125,000	May not be applicable for limestone. Rubber lining a dumptruck = £15,000; hopper £20,000 (if noise is a real problem); Calcs based on number of dumptrucks + 1 hopper. Assume noise control on fixed plant is included in engineering cost models.
Noise	Erection of permanent noise barriers eg tree planting and /or earth bunding	333,750	652,500	1,290,000	1,295,000	Construction of screening bunds depends on size required and available material - assume all pre-stripped material will be used. Cost per cubic metre approx 85p (max 1 km round trip). Tree planting depends on the quantity involved, allow £15,000 to £20,000 in total, but may be more. Calc: total hectares x 10,000 (to convert to sq m) x 1.5 m depth (middle of CSM assumptions) = approx cu m, x £0.85; plus tree planting at £15,000 for smaller sites and £20,000 for larger.
Contamination of land from chemical / fuel / oil spills	Containment bunds or double skinned tanks, drip trays for standing machinery, staff training in pollution prevention, adequate secondary containment systems	25,000	25,000	50,000	50,000	30,000 litre double skinned tank, skid mounted with alarm to indicate any spillage into the bund, pump contained in an appropriate cupboard with built in drip tray. Assume 1 tank for smaller sites and 2 for larger. In rare circumstances an interceptor may be required (not included here)
Soil handling	Soil manangemnt plan for removal, storage and return to use in restoration	0	0	0	0	Included in cost for erecting bunds
Increased levels of silt laden run-off with possible sedimentation of watercourses	Water management possibly including: settlement lagoons, attenuation areas and silt traps to remove or filter out sediments in runoff before discharge to a watercourse, licensed discharge point and monitoring.	0	0	0	10,000	Significant quantities are unlikely with limestone, unless it is deep. Equipment and manpower on site would be used, nominal sum for larger site
Alteration of water table, modification to water flows,	Licensed abstraction, transfer and discharge; monitoring	11,000	11,000	27,000	27,000	Abstraction licence: paperwork £1,000; pump trial £10,000; Discharge licence: paperwork £1,000; annual fee £10,000 to £15,000 Not every site will need one or other, assume larger sites are max cost of both, smaller sites assume only one and min cost.
Water pollution	Sewage from washroom facilities requiring connection to main sewers or cess pit	0	0	0	10,000	Cost of building itself is already included; Likely that connection would be included in the building cost, additional £10,000 if a klargester is needed.
Noise from traffic	Traffic-implementaion of traffic management plan to control vehicle movements	0	0	0	0	For internal roads this is all about maintenance - of the vehicles exhaust and tyres, and of the haul road. Internal equipment and staff would be used, no extra cost.
Increased traffic on local network	Traffic Management Plan to minimise congestion	100,000	100,000	500,000	500,000	External roads, small site would need a bellmouth £100,000; larger site would need a ghost island and road widening £500,000. If planning conditions insist on a roundabout it would cost £1 million.
Non-mineral wastes	Collection and licensed disposal (eg machinery parts, waste from offices/canteens, etc)	0	0	0	0	Revenue received from selling scrap metal would cover the costs for all other "bits and pieces"; office waste would go into a regular wheelie bin.
Distrubance to protected species	Accomodation of species elsewhere on site or on non-operational land	0	0	0	10,000	Completely unknown. A site would actively look after all species but most work would be done internally with no extra cost. Occasionally there are small one-off costs, for example installing an artificial badger sett costs £10,000.
Change in scenic quality of the view	Erection and maintenance of screening bunds	0	0	0	0	Erection of bunds included above under Noise.
Change in scenic quality of the view	Planting and maintaining trees	0	0	0	0	Included in cost above under noise.
	Sub-total	603,910	971,820	2,073,640	2,131,440	
	Cost per tonne (over entire site life)	0.08	0.08	0.08	0.03	

Table A 1.4: Cost estimates of environmental mitigation for underground crushed rock aggregate mines

Underground Mine		**Production levels** (see notes)			
CSM Assumptions	Tonnes per day	1,500	2,500	5,000	14,000
	Tonnes per annum	375,000	625,000	1,250,000	3,500,000
	Site life (years)	20	20	20	20
	Surface area (hectares)	20	25	35	65

Mitigation of Environmental Impacts		**Typical Costs £** (see notes)				Additional notes (underground mine)
Impact	**Mitigation (examples)**					
Dust	Installing / maintaining a wheel wash	80,000	80,000	80,000	80,000	Identical to surface quarry
Dust	Use of a road sweeper	4,160	8,320	16,640	24,440	Identical to surface quarry, assume all sealed roads at at the surface (ie in the plant area)
Dust	Suppression using water	0	0	0	0	Water bowser in production cost models, would need to be controlled for health and safety reasons (not environmental mitigation)
Dust/noise	Enclosure around fixed plant	Already included in production cost models				Identical to surface quarry
Noise	Extra cost of rubber lining equipment	0	0	0	0	Assumed that noise from extraction area is contained underground, therefore no need to rubber line dumptrucks or hopper. Assumed that noise control on processing plant is included in engineering cost models by CSM.
Noise	Erection of permanent noise barriers eg tree planting and /or earth bunding	270,000	333,750	461,250	848,750	Reduced due to smaller surface area (and therefore less soil available with which to construct earth bunds). Assume tree planting is predominantely around processing plant area and therefore identical cost to surface quarry. If there is a shortage of material to construct screening bunds then additional accoustic fencing may be required (not included here).
Contamination of land from chemical / fuel / oil spills	Containment bunds or double skinned tanks, drip trays for standing machinery, staff training in pollution prevention, adequate secondary containment systems	25,000	25,000	50,000	50,000	Identical to surface quarry, irrespective of whether located on the surface or underground
Soil handling	Soil manangemnt plan for removal, storage and return to use in restoration	0	0	0	0	Included in cost for erecting bunds
Increased levels of silt laden run-off with possible sedimentation of watercourses	Water management possibly including: settlement lagoons, attenuation areas and silt traps to remove or filter out sediments in runoff before discharge to a watercourse, licensed discharge point and monitoring.	0	0	0	6,500	Surface water run-off is reduced because it relates only to the processing plant area. Significant quantities are unlikely with limestone (as noted with surface quarrying).
Alteration of water table, modification to water flows,	Licensed abstraction, transfer and discharge; monitoring	22,000	22,000	54,000	54,000	As a minimum this would be similar to the surface quarry. It may actually be more depending on the ground water flows and therefore costs here are doubled. In reality it could be much higher if significant pumping is required.
Water pollution	Sewage from washroom facilities requiring connection to main sewers or cess pit	0	0	0	10,000	Identical to surface quarry
Noise from traffic	Traffic-implementaion of traffic management plan to control vehicle movements	0	0	0	0	Would be reduced as much of the traffic movement would be contained underground. However, even for the surface quarry it is costed as zero (see notes).
Increased traffic on local network	Traffic Management Plan to minimise congestion	100,000	100,000	500,000	500,000	Identical to surface quarry
Non-mineral wastes	Collection and licensed disposal (eg machinery parts, waste from offices/canteens, etc)	0	0	0	0	Identical to surface quarry
Distrubance to protected species	Accomodation of species elsewhere on site or on non-operational land	0	0	0	0	Likelihood of cost for this item is reduced because only the processing plant area is disturbed.
Change in scenic quality of the view	Erection and maintenance of screening bunds	0	0	0	0	Erection of screening bunds are included under noise.
Change in scenic quality of the view	Planting and maintaining trees	0	0	0	0	Included in cost above for noise.
	Sub-total	501,160	569,070	1,161,890	1,573,690	
	Cost per tonne (over entire site life)	0.07	0.05	0.05	0.02	

A 2 Costs of decommissioning and after care

It has been suggested that the relative scale of decommissioning, restoration and aftercare costs for surface quarrying and underground mining for aggregates would be a function of the 'land take' of the production operation. In other words the expectation is that less restoration would be required for underground mining because it requires less land area on the surface.

In reality the situation is more complex than that implies, with the scale of restoration being significantly dependant on the individual after-use identified for each specific site. Consequently, a set of 'generic' cost models are almost impossible to obtain because there is such a wide variety of possible end uses and each site will have particular circumstances which are unique to that location.

A real potential site for an underground mine would require a detailed feasibility study, which would need to address the issue of after-use as this would form part of its detailed planning proposals, and careful consideration of the associated costs for decommissioning, restoration and aftercare would be included.

This research is specifically looking at the feasibility of a new 'green-field' location and not the option of developing underground from an existing surface quarry. In many cases the latter is more likely to be economic because the site infrastructure will already be in place. However, even in this circumstance, any extension underground would require additional planning permission which would need to include a detailed proposal for decommissioning, restoration and aftercare of the proposed extension.

A 2.1 Decommissioning, restoration and aftercare costs

Many of the costs identified in this research would occur with both a surface and underground operation and consequently for the purposes of this research they effectively cancel each other out. The overall aim of this study is to identify the cost differential between the two methods of working, however, in order to reach this differential it has been necessary to attempt an itemisation of the likely costs that would be incurred in order to more easily identify where differences apply.

Specific items considered in this research for decommissioning and restoration are shown in Table A 2.1, with comments relating to the differences that apply to underground mining. The responsibility of the extraction site operator for aftercare costs is usually limited to a few years after restoration is complete. Subsequent costs, together with the costs related to the after-use itself, would form part of an agreement with any subsequent developer. Examples of items relating to aftercare for different types of after-use category are shown in Table A 2.2. Indications of the 'typical' or 'possible' costs associated with these specific items are shown in Table A 2.4 and Table A 2.5.

Table A 2.1: Items considered as likely requirements during decommissioning and restoration phases

Item considered	Surface quarrying	Underground mining
Disconnect services	Cost applies to plant area and site buildings only	Will be the same for the plant area, however overall may be lower if some services continue as a result of specific after-use (e.g. electricity for lighting)
Dismantle and remove fixed processing plant	Revenue gained from sale of scrap metal will cover this cost	Will be the same. Installation of sub-surface access equipment (e.g. shafts, winders, etc) more suited to the scale of activity for the after-use may be installed. Buildings housing ancillary services (e.g. compressed air, electrical switchgear, workshops) that may continue to be required in the after-use phase may not be removed.
Remove mobile plant (including the dismantling of larger machines)	Depends on the number of pieces of equipment	Will be the same
Emptying fuel and chemical storage tanks and removing liquids, including licensed disposal if necessary	Likely that stock would be run down and no extra cost would therefore be incurred	Will be the same
Removal of storage tanks used for fuels or chemicals	Possibly relocate to a new site	Will be the same
Removal or demolition of office buildings	Could be a good quality ‘portacabin’ type and therefore cost is relocation	Will be the same
Removal of workshop equipment and buildings	Likely that most would be dismantled, relocated and reused	Will be the same
Removal of hard surfacing from fixed plant area	Revenue gained from recycling the concrete would cover this cost	Will be the same
Removal of internal roadways	Unsealed roadways could be left in place, depending on after use	Depends on after use, more likely to be left in place
Soil movements (i.e. respreading of material from soil storage bunds, infilling and reshaping of landscape)	Similar cost to that involved with soil stripping at the start of the operation.	Will be much less because soil only stripped from processing plant area
Importation of inert or soil materials	Avoid at all costs because it would be expensive; may be unlikely because all soils would be retained on site	Even less likely to be needed for restoration purposes because of smaller ‘land take’
Installing drainage system (surface water and ground water)	Unlikely to be necessary for a site working limestone (due to natural drainage through the rock)	Difficult to quantify, may be greater if there is significant ground water inflow, depends on local conditions
Grass seeding, tree and shrub planting, including protection from herbivores and weed control	Depends on after use, e.g. nature conservation costs more than agriculture	Would be less because it would only apply to the area of the processing plant
Rock fall protection	Depends on linear length of quarry benches, but extra cost may be low if incorporated into overall quarry design	Depends on after use, if people need to access the underground space it will be required and may cost more (because rock fall is possible from the ceiling as well as the extraction faces)

Table A 2.2: Items considered as likely requirements during the after-care phase

After-use	Item considered	Surface quarrying	Underground mining
All uses	Site security	Usually minimal additional cost	May be greater depending on after-use
	Maintenance of planting (e.g. grass or hedge cutting, weed control, replacements if trees/shrubs die, etc)	Usually applies for a limited period	Will be less because less planting will be carried out
Agricultural	Additional drainage, additional soil management, additional fertilizer	Could be quite low once restoration is complete	Will be less as it only applies to area of processing plant.
Buildings	Maintenance of access roads Maintenance of rock fall protection Maintenance of water pumps Maintenance of edge protection where there are drops	Cost would depend on the agreement reached with a developer, likely that the costs would be passed on to the developer	Some costs are likely to be greater than surface quarry, but again would probably be passed on to the subsequent developer
Waste disposal	Construction of seal / liner, monitoring to avoid pollution	Expensive after use due to the requirement to construct the seal/liner, but also generates revenue and therefore usually considered as a separate business activity	Similar comments apply
Nature conservation	Habitat maintenance requirements	May be very little extra cost once restoration is complete	Would be less because it only applies to former plant area

A 2.2 Assumptions made during decommissioning, restoration and aftercare cost modelling

Due to the wide range of variables that have a bearing on the cost of decommissioning, restoration and aftercare, a number of assumptions have had to be made regarding the scale and nature of the aggregates extraction operation (both for surface and underground sites). A number of these were taken from the assumptions made for the engineering cost modelling exercise, and these are outlined as follows:

- It is assumed that the extraction site is working limestone, which has a bearing particularly in terms of water management.
- There are four different production scales (in terms of tonnages extracted) and associated equipment requirements, as outlined in Table A 2.3. These have implications in terms of 'land take' for surface quarrying and underground mining.
- The different production scales also have a bearing on decommissioning and restoration costs in terms of the quantity of equipment that needs to be removed. However, most of these costs would be identical between surface and underground operations.

Table A 2.3: Relevant site specific assumptions made depending on size of operation

Assumptions	Site 1	Site 2	Site 3	Site 4
Tonnes per day	1500	2500	5000	14000
Tonnes per annum	375,000	625,000	1,250,000	3,500,000
Life of site (years)	20	20	20	20
Reserve (million tonnes)	7.5	12.5	25	70
Number of pieces of mobile equipment	8	11	16	17
Relating to Surface Quarrying				
Ultimate surface area (hectares)	25	50	100	100
Bench height (metres)	15	15	15	15
Number of benches (calculated from circumference and bench height)	5	5	5	12
Relating to Underground Mining				
Surface area for plant and buildings (hectares)	20	25	35	65

Table A 2.4: Cost estimates of decommissioning, restoration and aftercare for a surface quarry

Surface Quarry		**Production levels**				
Assumptions	Tonnes per day	1,500	2,500	5,000	14,000	
	Tonnes per annum	375,000	625,000	1,250,000	3,500,000	
	Site life (years)	20	20	20	20	
	Ultimate surface area (hectares)	25	50	100	100	
	Pre-strip surface area (hectares)	13	25	50	50	
Decommissioning and Restoration		**Typical Costs £**				Additional Notes (Surface Quarry)
Disconnect services		1,000	1,000	1,000	1,000	Minimal, few £1000 max.
Dismantle and remove fixed plant		0	0	0	0	The revenue gained from the scrap value would pay for this.
Remove mobile plant (including dismantling large items)		4,000	5,500	8,000	8,500	The cost of a low-loader is approx £500 if transporting 50 miles, or £1000 if further. Calcs based on number of pieces of equipment in CSM's document which are likely to need a low-loader to move to a new site (operating cost, middle soil depth).
Emptying fuel and chemical storage tanks and removing liquids,		0	0	0	0	Site would simply run the stocks down.
Removal of storage tanks used for fuels or chemicals		2,000	2,000	4,000	4,000	Assume these are modern, double-skinned tanks that could be relocated to a new site, therefore cost depends on how far they are going, assume 2 tanks on the larger sites and 1 on the others.
Demolition of office buildings		3,000	5,000	5,000	9,000	Likely to be a good quality portacabin which can be relocated and reused. Assume 1 cabin for the small site, 2 for the medium and 4 for the largest site. Cost of relocation approx £1000 for crane hire and £2000 for a suitable lorry each.
Removal of workshop equipment and demolition of buildings		15,000	17,500	20,000	20,000	Most equipment would be dismantled and reused, revenue gained from scrap would pay for disposal of any other equipment. Assume income from recycling building materials would also generate revenue. Amounts shown are nominal sums for "extra" costs, such as moving equipment to a new site. CSM models assume the two larger sites have a workshop of the same size, therefore assume it would be the same cost.
Removal of hard surfacing from fixed plant area		0	0	0	0	Revenue gained from recycling the concrete would cover this cost
Removal of internal roadways		0	0	0	0	As above if they are concrete, other haul roads would just be left
Soil movements (ie respreading of material from soil storage bunds), infilling and reshaping landscape		318,750	637,500	1,275,000	1,275,000	Same cost as constructing the bunds under "mitigation" (without the tree planting part)
Importation of inert or soil materials		0	0	0	0	Avoid at all costs because it would be very expensive. Inconceivable in modern times because all sites would keep what soils they had and respread whatever they have stored.
Installing drainage system (surface water and ground water)		70,000	140,000	280,000	280,000	Unlikely to be necessary with limestone, but if required would cost £2,800 per hectare
Grass seeding, tree and shrub planting including protection from herbivores and weed control		131,250	262,500	525,000	525,000	Cultivation and seeding of agricultural grass = £600 per hectare, conservation grade grass is more expensive = £1200 per hectare; tree planting allow 3000 trees per hectare at £2.50 each; installing hedges costs £9 per linear metre (double row planting) plus £6 per linear metre for fencing to protect the hedging plants while they grow. Calcs assume most expensive type of grass, trees on half area and length of hedges in proportion to area.
Rock fall protection		2,500	5,000	10,000	24,000	Depends on linear length of benches: 30 tonne wheel loader hire (with driver) costs £500 per day, would create half a km per day. Calcs based on 5 benches for smaller sites x approx circumference (although lower benches would have smaller circumference), 12 benches for the larger one; assumes site is approximately circular
	Sub-total	547,500	1,076,000	2,128,000	2,146,500	
	Cost per tonne (over entire site life)	0.07	0.09	0.09	0.03	
Aftercare Period		**Typical Costs £**				
Site security		0	0	0	0	not considered necessary for surface quarry
Maintenance of planting (eg grass or hedge cutting, weed control,		5,000	10,000	15,000	20,000	Depends on length of aftercare period
Agricultural after use:	Additional drainage, additional soil management, additional fertilizer	0	0	0	0	no significant cost once restoration complete
After use involving buildings:	Maintenance of access roads,	0	0	0	0	Likely these would be passed on to the subsequent developer
After use involving buildings:	Maintenance of rock fall protection,	0	0	0	0	
After use involving buildings:	Maintenance of water pumps	0	0	0	0	
After use involving buildings:	Maintenance of edge protection where there are drops	0	0	0	0	
After use involving waste disposal:	Construction of seal / liner, extensive monitoring to avoid pollution	0	0	0	0	Would need a fully engineered seal / liner which in a limestone quarry would most likely be a geo-textile. The cost for a 300,000 tonne "cell" (approx 16,000 m2 x 15 m deep) at a sand and gravel quarry using clay as a liner is £500,000; monitoring = £15,000-£20,000 per year. However, as this activity would also generate revenue it is likely to be treated as a completely separate business activity.
Nature conservation after use:	Monitoring to identify habitat maintenance requirements (Geo-conservation would be similar)	5,000	10,000	15,000	20,000	Very site specific, nominal sums included.
Totals for this section are not applicable (they depend on the particular after use selected)						

Table A 2.5: Cost estimates of decommissioning, restoration and aftercare for an underground crushed rock aggregates mine

Underground Mine		Production levels			
Assumptions	Tonnes per day	1,500	2,500	5,000	14,000
	Tonnes per annum	375,000	625,000	1,250,000	3,500,000
	Site life (years)	20	20	20	20
	Surface area (hectares)	20	25	35	65

Decommissioning and Restoration		**Typical Costs £**				Additional Notes (Underground Mine)
Disconnect services		0	0	0	0	Assumed that all services need to be retained for after use
Dismantle and remove fixed plant		0	0	0	0	Identical to surface quarry
Remove mobile plant (including dismantling large items)		4,000	5,500	8,000	8,500	Identical to surface quarry
Emptying fuel and chemical storage tanks and removing liquids,		0	0	0	0	Identical to surface quarry
Removal of storage tanks used for fuels or chemicals		2,000	2,000	4,000	4,000	Identical to surface quarry
Demolition of office buildings		3,000	5,000	5,000	9,000	Identical to surface quarry
Removal of workshop equipment and demolition of buildings		15,000	17,500	20,000	20,000	Identical to surface quarry
Removal of hard surfacing from fixed plant area		0	0	0	0	Identical to surface quarry
Removal of internal roadways		0	0	0	0	Assume they will just be left
Soil movements (ie respreading of material from soil storage bunds), infilling and reshaping landscape		255,000	318,750	446,250	828,750	Reduced due to smaller surface area (and therefore less soil available with which to construct earth bunds). If there is a shortage of material to construct screening bunds then additional fencing may have been required and would need to be removed (not included here).
Importation of inert or soil materials		0	0	0	0	Likelihood would be reduced because it only applies to the processing plant area.
Installing drainage system (surface water and ground water)		140,000	280,000	560,000	560,000	Could be reduced if only required for processing plant area, however, may be much greater if there is significant ground water inflow. Assume double surface quarry.
Grass seeding, tree and shrub planting including protection from herbivores and weed control		106,500	138,750	203,250	351,750	Reduced due to smaller surface area (plant area only)
Rock fall protection		5,000	10,000	20,000	48,000	Depends on after use, may be more expensive, assume double surface quarry
	Sub-total	530,500	777,500	1,266,500	1,830,000	
	Cost per tonne (over entire site life)	0.07	0.06	0.05	0.03	

Aftercare Period		**Typical Costs £**				
Site security		20,000	20,000	20,000	20,000	Depends on after use, nominal sum included
Maintenance of planting (eg grass or hedge cutting, weed control,		4,000	5,000	5,250	13,000	Reduced because less planting
Agricultural after use:	Additional drainage, additional soil management, additional fertilizer	0	0	0	0	no significant cost once restoration complete, processing plant area only
After use involving buildings:	Maintenance of access roads,	0	0	0	0	
After use involving buildings:	Maintenance of rock fall protection,	0	0	0	0	Likely these would be passed on to the subsequent developer
After use involving buildings:	Maintenance of water pumps	0	0	0	0	
After use involving buildings:	Maintenance of edge protection where there are drops	0	0	0	0	
After use involving waste disposal:	Construction of seal / liner, extensive monitoring to avoid pollution	0	0	0	0	Unlikely to occur in the surface area (where the processing plant was located). Quantity of space available underground is difficult to quantify, as are the requirements to ensure the waste is secure and to prevent pollution escaping. Cost may be greater per unit of waste because ground water inflow is likely to be greater, but actual waste quantities could be lower. Likely to be treated as a separate business activity.
Nature conservation after use:	Monitoring to identify habitat maintenance requirements (Geo-conservation would be similar)	4,000	5,000	5,250	13,000	Reduced because this would only be a suitable after use for the plant area
Totals for this section are not applicable (they depend on the particular after use selected)						

A 3 Health & Safety Costs – Underground vs Surface Mining

Risks in mining can be categorised as resulting from either 'major mining' hazards, or occupational hazards (Foster, 1996). Major mining hazards are those high severity-low likelihood risks that are traditionally and uniquely associated with mining operations and include hazards such as fires, explosions, inrushes, major falls of ground etc. Occupational hazards are those that are associated with work activity generally, and are common in all the majority of occupational environments. These include manual handling, slipping & falling, vehicle movements, machinery hazards, and spillage of product from vehicles, conveyors and winding gear.

When considering safety, it is assumed that underground mining is more dangerous than surface mining. This is borne out, to some degree, by looking at historical accident statistics. Also, if one considers the major mining hazards there are more high severity-low consequence risks in underground mining then surface mining, and this also contributes to this assumption.

In terms of controlling these major hazards, all the design and engineering issues and their associated costs, are already by implication incorporated into the cost models. Examples of such hazards and associated controls are given in the Table A 3.1.

Table A 3.1: Underground Mining Hazards

Hazard	Typical Control Measures
UG: Falls of Ground	Geotechnical Assessment & Design; Support (steel arches, roof bolts etc)
UG: Inrushes	Mine Design (provision of pillars) In seam longhole drilling
UG: Fires & Explosions	Stonedust and water barriers; Environmental Monitoring Systems; Fire resistant materials
OC: Highwall Collapse	Geotechnical Assessment & Design

As well as the generic engineering and design control measures suggested above, all these hazards have supplemental controls such as Managers Rules, Codes of Practice, Training and Supervision. Again the cost of these 'administrative' type control measures are already incorporated within the Operating Cost models.

The only additional costs not considered so far, are those associated with escape and rescue and these apply more to underground mining environments.

In terms of legislation these measures are all to satisfy Regulation 12 of the Escape and Rescue from Mines Regulations, 1995, which require the Mine Owner to make effective arrangements for rescue. The biggest expenditure here would be related to the risk an irrespirable atmosphere occurring below ground in a quantity that requires the use of breathing apparatus or self havens to aid escape. In an underground aggregates mine the principle source of such an atmosphere would be through fire on a vehicle's diesel engine.

A formal risk assessment would have to be undertaken by the mine to see if failing to escape due to an irrespirable atmosphere is a significant risk. In making such an assessment, the following must be considered:

- the layout of the mine and numbers of people likely to be present in different parts, especially blind ends;
- the rate at which products of combustion might spread through the mine and the capacity of the ventilation system to dilute them;
- the walking time from the working area to fresh air, taking into account gradients; and
- the availability, if any, of transport that could be safely used.

If this is a significant risk then this will have to be reduced to a level that is as low as is reasonably practicable which will involve additional costs. Such costs will be associated with one or more of the following:

- buying in emergency cover from an organisation such as the “Mines Rescue Service” (This is location dependent).
- maintaining an in-house mines rescue team and associated equipment;
- installing ‘self havens’ underground;

A 3.1 Buying in Emergency Cover

Where a mine is within 60 minutes response time of one of the five Mines Rescue Service Stations, the Mines Rescue Service Ltd can provide, at a cost, rescue cover. This cost consists of an annual retainer, as well as a separate cost charge for any call out.

The Annual Fee for the current year for such cover is £3,040 (MRSL, 2009). The call out charge consists of vehicle mileage (£0.60 per mile) as well as salary, wages & emergency payment to Mines Rescue Staff for the duration of the emergency.

The five Mine Rescue Stations are located in Mansfield, Dinas (South Wales), Kellingly (Yorkshire), Crossgates (Fife) and Rawdon (South Derbyshire). If the underground aggregates mine is outside these areas, and an irrespirable atmosphere is a significant risk, then the mine would have to have some form of in-house cover.

A 3.2 In-house Rescue Provision

In house rescue provision would consist of at least one rescue team consisting of five persons. This would normally be the case even if there was brought in emergency cover.

If brought in cover was not available and an irrespirable atmosphere is a significant risk then the mine would have to buy in and maintain portable breathing apparatus. Such apparatus should be of the close-circuit type, so the user is independent of the surrounding air and the typical capital cost per unit (eg Drager PSS BG4) is £7,000.

A 3.3 Self-Havens

Self-havens are defined as (HSE, 1997) a place with facilities including an independent air supply to maintain an atmosphere at positive pressure (eg greater than the surrounding atmosphere), so people can wait in safety until rescue arrives. Safe-havens need to have a telephone or tannoy so that people inside can communicate their presence and messages can be sent from the surface. The need for safe-havens is a direct function of the distance of the active mine workings from the shaft or adit (or other source of fresh air).

Following the Sago mine disaster in the US in 2006, there has been a great deal of research and development into self-havens. A ‘state of the art’ portable self-haven system (Strata Safety Products Portable Fresh Air Bay) has recently been delivered to British Gypsum underground mines in the UK at a cost of £52,000 per unit. These are trailer units and can be moved around the mine so they are always near to the current working area. This removes the requirement for the more traditional static self-haven built between two pillars within a working district, which has to be rebuilt each time in a new working district. These would be the choice, if required, within our underground aggregates operation.

Cost per unit: £52,000

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix B

After Uses of Voids Created by the Underground Mining of Aggregate

May 2010

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B 1 After-use of voids created by underground mining of aggregates

As the term suggests, 'underground' or 'subsurface space' refers to any space that is below ground level, while 'surface space' is above ground level (Ronka et al., 1998). For millennia, man has made use of the subsurface, initially with natural caves for shelter. With time he created underground spaces through mining for living, storage and disposal by burial. More recently he has increasingly made use of the pore space in sedimentary rocks to store gas and fluids.

B 1.1 Survey of precedent practice in utilisation of voids created by underground mining

Use of the underground has contributed to sustainable development and to improvements to the environment and quality of life. Because of the pressure on land in urban areas (in particular major cities), underground infrastructure is often necessary and includes not only utilities, pipelines and underground train lines, but also buildings, with some developments in Washington, USA, extending up to seven floors below ground level. In order to alleviate pressures on land in many countries with rapidly expanding cities (e.g. in Japan and particularly in the fast developing areas of China), there are plans for major underground infrastructure, including storage, road, rail (metro's) and bus stations. Increasingly, environmental issues have become major factors in the design and construction of underground facilities (Parker, 2006): underground facilities must not harm the environment through which they pass and the adjacent surface, facilities, and surrounding environments must not be adversely affected.

In the UK, with the exception of small scale local examples, almost all the stone for chemical, metallurgical and civil engineering uses has been (and still is), obtained by surface extraction techniques. However, close to some major markets there has been a gradual depletion of easily and cheaply worked deposits free from planning or other land use constraints and available for quarrying. This is particularly so in southeast England, where since the late 1970s, the Thames Valley sand and gravel deposits have, for example, supplied a decreasing proportion of regional market demand. As a result, aggregate production cannot continue to ensure meeting demand in the area and alternative schemes are examined periodically to provide long-term solutions to that issue. As early as 1979 there was growing interest in Britain in the possibility of opting for underground, rather than surface, extraction methods for low value aggregates. Such a policy offered reduced environmental impact and cost advantages to the producer and studies were undertaken based upon underground stone mining potential in the southeast of England (Stocks 1973, Stocks, 1979).

Since these early studies, the pressures on land have only increased and the introduction of stricter environmental regulations regarding the operation of open-pit quarries in many areas of the UK and Europe has resulted in the closure of, or refusal to permit, many quarrying operations. Further environmental restrictions and the pressures on land around urban areas suggest that interest in the underground mining of aggregates is only likely to increase. The possibility of using the mined space once mining has finished means also that the value of the underground space is likely to increase. The careful planning of the mining operations also enhances the value of the mined space by offering after mining uses, as evidenced by developments in Greece (see Section B 1.1.1 below).

An important first call on the underground void space created through underground aggregates mining could be for back stowage of aggregates mining waste after processing. Such measures would reduce surface impact of underground aggregates mining in comparison to surface quarrying but may also be a requirement of the new mine waste management arrangements being introduced by the Environment Agency in implementation of the recent EU Mine Waste Directive. Such measures and requirements could reduce the scope for commercial, alternative, after uses underground.

In addition to voids created by mining or by other human excavation, there are natural microscopic spaces (pores) in underground rocks. These can contain fresh or saline water, or sometimes oil or gas. These pore spaces can be used to store or dispose of a range of materials including energy (natural gas) or CO_2, and their contents can be a source of natural heat and water (geothermal energy). However, for the purposes of this report, such pore storage is not discussed further.

B 1.1.1 Light-industrial and warehousing uses

In Athens, limestone for aggregate is now mined underground, with the mine design process involving the utilisation of the underground space, which is regarded as providing opportunities for real estate development. One such example is the development of an underground Warehousing – Logistics Centre (Benardos et al., 2001; Zevgolis et al., 2004).

There are many examples of underground facilities in old mined areas elsewhere in the world, with a number of large developments in the USA, including around Iowa; Pittsburgh, Pennsylvania; Louisville, Kentucky; St. Louis and Kansas City, Missouri; and Indianapolis, Indiana (Buzzbee, 2009). Many are in former limestone mines supplying crushed limestone aggregate and are used for light industry (excluding chemical use), warehouse space, records storage, and offices.

The Bradys Bend Underground Storage in East Brady (Pennsylvania, USA), is an operating mine, with the mined space converted to provide a 2.8 million m^2 facility for storing records and vehicles. In addition, Kentucky Underground Storage in Wilmore, Kentucky, is used as a warehouse facility storing paper records, magnetic data, videotapes and microfiches (Buzzbee, 2009).

Kansas City (Missouri, USA) is an international leader in the commercial development of mined-out areas for warehousing, manufacturing, offices, business, and service-related activities (Gentile, 1997; Buzzbee, 2009). In the late 1990s, over 3000 people worked underground at about two dozen sites (Gentile, 1997). Today, there are around 30 underground business parks in the area, housing over 400 businesses with a combined floor space of circa 2 sq km (Buzzbee, 2009).

There are many reasons for the large-scale development and utilization of mined-out areas at Kansas City, but foremost is the availability of vast areas underground that could be developed at low cost and the geographical location of Kansas City as a hub of transportation near the centre of the USA. The most common use of the space is for storage and the construction costs involved in the preparation of occupancy of most abandoned mines are relatively inexpensive compared to surface facilities of comparable size (Gentile, 1997).

The limestone beds are mined by tunnels excavated directly into the hillside. Some mines extend into the hill only a few hundred meters, whereas in others the working face is almost 2 km from the entrance. The majority of the operating mines are shallow and are located in relatively sparsely populated areas of the city and produce rock that is crushed to several size grades for a variety of purposes including construction. Most of the developed areas of the mines are 10–60 m below ground level. The value of the mined-out area is usually more than the mined product and therefore, as space becomes available after mining operations, it is converted to commercial use. In addition, the surfaces above the mines are developed at an increasing rate as the city expands outward into suburban areas.

Two of the biggest developed underground mine areas in Kansas City are the SubTropolis and Springfield developments. Subtropolis is owned and operated by Hunt Midwest Real Estate Development and covers 370 hectares (913 acres). It has 10.5 km of roads and 3.4 km of rail tracks, with multiple entries within the city centre (Buzzbee, 2009). The limestone mine at Springfield covering 223 hectares (550 acres) operated in the 1960s, creating caverns 9-12 m in height. It has more than 185,806 m^2 of floor space and 2.1 million m^3 in underground buildings, providing underground manufacturing, distribution and storage facilities, including 55,742 m^2 of refrigerated and frozen storage (O'Keefe, 2009).

The site includes one of the largest underground cold storage, processing and distribution plants, built by Willow Brook Foods who lease around 20,903 m2 of space at the site. They operate a state-of-the-art slicing and packaging facility occupying 2,323 m^2, with freezers, coolers and loading bays (O’Keefe, 2009).

Elsewhere in Missouri, the Bussen Underground Storage in St. Louis County is a limestone mine engineered and mined for the specific purpose of creating a climate controlled warehousing facility. Over 13,000 m^2 storage space is currently available (Bussen Quarries, 2009). It should be noted that the circumstances leading to this and other USA experiences may have arisen due to the relatively less densely populated areas in which they were developed, and thus such after-uses may well not map comfortably to the densely populated, often congested SE region of England.

As well as the examples in the USA, underground voids have been used for warehousing and palletised cold and frozen food storage in Scandinavia and China (Carmody & Sterling, 1993; Gentile, 1997; Buzzbee, 2009), where it has proved less costly than surface storage due to the lower energy requirements of a constant underground environment (Dames & Moore, 1983).

Limestone and building stone mining voids have been used in the UK and elsewhere for light industrial purposes and even mushroom farms. Former building stone mines in Wiltshire have been utilised extensively in the past to house government facilities related to emergency and military planning. Voids created by historic mining of building stone and industrial limestone by driving tunnels in from surface or shallow mining

(<50 m depth) in areas such as Wiltshire, Dorset and Derbyshire have been used for commercial cold storage, wine and grain storage and, extensively, for the secure storage of documents, munitions and explosives. Any new proposal to mine aggregate from the subsurface would have to negotiate proposed after uses through the planning system at the point of permitting the mine. The example excavations cited were created in an era where after uses were not relevant to the decision to mine and in the absence of modern planning and environmental concern.

B 1.1.2 Agricultural Production

The shallower limestone and building stone mining voids in the UK have been used as mushroom farms and elsewhere in the world for poultry farming (Tagwerker, 1963).

B 1.1.3 Waste management

In the UK, part of the Winsford Mine is used by Veolia Environmental Services for the disposal of selected wastes. The need for such a facility was created in 1997 as a response to the EU Landfill Directive which required the ending of co-disposal of different categories of waste in surface landfills. In 2003 the company received planning permission for this storage facility in part of the disused mine area about 170 m underground. The mine began accepting waste in the summer of 2005. Planning permission allows for the disposal of up to 100 000 t/y of suitably packaged wastes, the range of which is defined in the Integrated Prevention Pollution and Control (IPPC) permit issued by the Environment Agency. All waste must be in either solid, granular or powder form, but must not include flammable, reactive, volatile, biodegradable or radioactive waste products. The principal waste stream is residues from energy and waste plants.

Middleton Mine, near Cromford in Derbyshire represents the largest underground limestone mine in the UK. Opened in 1959 it produced some 15 million tonnes of high purity limestone of Carboniferous age for a range of industrial applications. Annual output was up to 400 000 t/y. However, although still leased to OMYA by Tarmac, the mine closed in late 2006 as high purity limestone could be supplied more economically from Dowlow Quarry, near Buxton. The mine is very extensive with a void space exceeding 6 million m^3 in 35 km of tunnels.

The mine is not used currently for any storage, although this has been considered. It has consent for the storage of cement clinker, but this was never implemented. The mine has storage potential but any requirement would need to take into account that the atmosphere underground has a high humidity at all times of the year, especially during midsummer. There is now no ventilation or power infrastructure.

B 1.1.4 Liquid hydrocarbon storage

For many years, mined voids have been used to store energy in the form of liquid hydrocarbons, with many examples around the world. Many of the facilities comprise caverns leached in thick massive halite beds or salt diapirs, but storage is also known in other rock types, including crystalline (granitic and migmatitic) rock (e.g. Porvo, Finland and Ravensworth, Virginia, USA) and chalk (e.g. Demopolis, Alabama, USA). LPG was first stored in salt caverns in Canada in the late 1940s/early 1950s (Tomasko et al. 1997), whilst first being stored in caverns in Texas during the 1950s (Brassow 2001). In the context of SE England, this would potentially be a controversial after-use that may not be successful in gaining public support or negotiation through the planning system.

B 1.1.5 Hydrocarbon gas storage

Use of salt caverns for natural gas storage is, however, more recent with the first storage having taken place in 1961, when the Southeastern Michigan Gas Company leased an abandoned salt cavern from the Morton Salt Company near Marysville, Michigan, USA (Allen 1972). This was followed in 1963 by the first salt cavern specifically designed and constructed for the storage of natural gas at Melville, Saskatchewan, Canada by the Saskatchewan Power Corporation. The first purpose built caverns in the USA, at the Eminence Dome, Mississippi were constructed in 1970 (Allen 1972; Thoms & Gehle 2000).

Examples of gas storage in abandoned mines with other rock types are rare with none presently operational, but have included the Leyden coalmines (Jefferson County, Denver, Colorado) and coalmines in the Anderlues and Péronnes mines in the Hainaut coalfield of southern Belgium (Piessons & Dusar, 2003). An old iron mine in May-sur-Orne, northern France, with a capacity of 5 million m^3 was also used to store hydrocarbons but was decommissioned several years ago.

In 1985, to ensure that peak winter demand for LPG can be met, mined caverns in the Chalk were engineered near Killingholme in North Lincolnshire for the storage of LPG (Geol Soc. 1985). The caverns are jointly operated by ConocoPhillips and Calor Gas Ltd., and LPG containment in the unlined chalk caverns is provided by the groundwater pressure in the chalk surrounding the cavern exceeding the maximum vapour pressure of the propane. Again, it should be noted that this would be another extremely controversial after use proposal for the SE area of England

B 1.1.6 Compressed air energy storage

Compressed air energy storage (CAES) is likely to increase in the future and might be considered as a commercial use of void created by aggregate mining. It involves using off-peak electricity from renewable sources such as wind, or excess output from coal, gas or nuclear power plants, to compress air, which is then stored under pressure underground and released through a gas turbine to generate electricity during periods of peak demand.

Storage for CAES can be in porous rocks or, more commonly, in large voids such as salt caverns (Crotogino et al. 2001; Leith 2001; Cheung et al. 2003), and former mine workings such as the limestone mine in Norton (Ohio, USA), which is at a depth of 670m below ground and covers an area about 2130m by 1220m with a volume of 9.6 million m^3 (http://www.caes.net/nortpres.html; Evans, 2008). Although well below the water table, the mine is said to be virtually dry. The example of the Norton mine is similar to the type of void likely to be created by aggregate mining.

The former Central Electricity Generating Board (CEGB) undertook CAES feasibility studies in the 1980s but development is yet to take place in the UK.

B 1.1.7 Scientific laboratories

Deep underground voids have applications when there is a need to isolate facilities from influences such as vibrations or natural radiation that are much more prevalent at surface, as seen in the example of the working Boulby Potash Mine in North East England. The Boulby Mine provides the location for a research laboratory 1.1 km underground. The laboratory was built by the University of Sheffield in partnership with the CCLRC (now STFC) Rutherford Appleton Laboratory in 1999 to study so called ‘dark matter’. The mine offers protection from cosmic rays and other natural radioactivity in the surroundings that would otherwise make the experiments impossible. Other research requiring similar controlled and isolated environments could make use of such subsurface space.

B 1.1.8 Museums and Tourist Attractions

In the UK, there are a number of examples of former mines being converted to mining museums in North Wales (slate; e.g. Carnglaze in Cornwall and Llechwedd, near Blaenau Ffestiniog), the Peak District National Park (Blue John), Yorkshire (coal, e.g. the National Coal Mining Museum for England) and Cornwall (copper and tin, e.g. Poldark Mine, near Helston and Geevor Mine, near Land’s End). During World-War II, one of the three Carnglaze caverns were used to store rum by the Royal Navy. More recently, Carnglaze has become well known as an auditorium for recitals and concerts.

B 1.1.9 Summary of after uses for underground space which are already known

Underground space is, therefore, an important resource that will increasingly be exploited for everyday use (refer Evans et al., 2009 in press). Some of the uses highlighted within this section and other examples already known are summarised in Table B 1.1. Figure B 1.1 illustrates the general relationship between type of after use and the depth of void – based on economic studies for bespoke construction of sub-surface facilities undertaken by Ronka *et al.*, 1998. In reality, strong social and practical considerations mean that the use to which underground space is put depends to a large extent on the depth below the surface at which it occurs. Public acceptability of after-uses is also highly relevant and will bear on the initial decision to mine.

Table B 1.1: Categories, with examples, of potential underground space use (both from the UK and worldwide).

Category	**Uses**
Energy	Compressed air storage, gaseous fuel storage, geothermal energy, hydroelectric pump storage, hydropower, liquid fuel storage energy from waste / bioreactor. Note: Many of these could be highly controversial with the public.
Entertainment & Leisure	Dining room (restaurants), theme park, wedding venue, art gallery, museum, health & fitness centre.
Sport	Climbing wall, diving centre, hypoxic running track, ice rink, motocross track, swimming pool, UG cycling track, indoor ski slope.
Food & Drink	Cheese store, fish farm, poultry farm, mushroom farm, wine cellar.
Civil / Civic / Infrastructure	Below ground car parking, car battery recycling plant, salt barns, data store (both paper copy and electronic/magnetic media), desalination plant, electronic data centre, sewage plant, shopping centre, underground water reservoir.
Medicine & Therapy	Medicinal plant cultivation, radon therapy (which would need careful handling from public perception and public health standpoints), salt therapy, sauna.
Other/industry/storage	Cemetery, explosives factory, factory, munitions depot, protection bunker, tree nursery. Note: Many of these could be highly controversial with the public.
Science & Technology	Dark matter research, elevator laboratory, science & engineering laboratory, carbon sequestration.

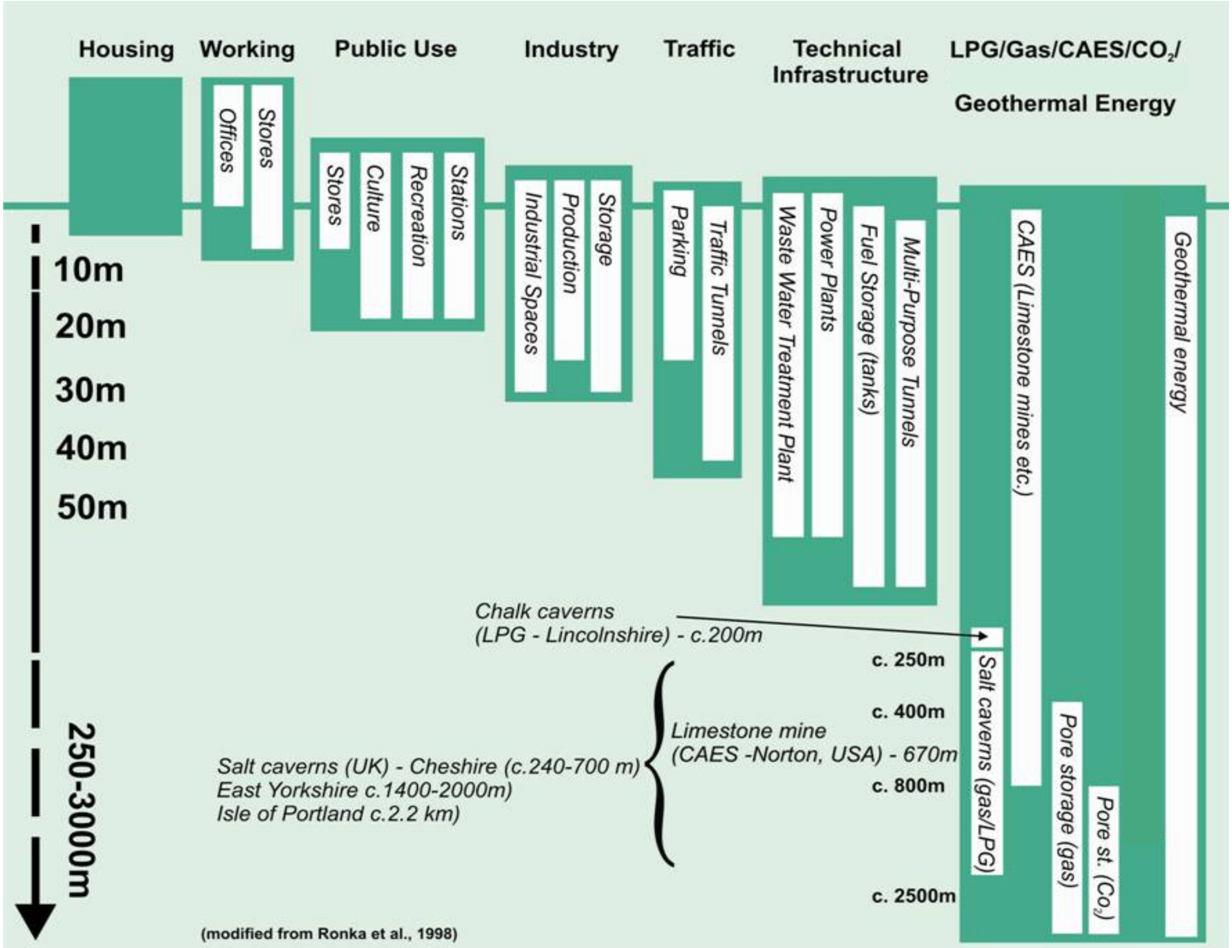

Figure B 1.1: Feasible depth ranges for underground activities, with some examples of large void use arising from underground mining or extraction of minerals (based on Ronka et al. 1998).
Note: CAES = Compressed Air Energy Storage

B 1.2 Factors affecting the potential after uses of void created through underground aggregates mining in the South East area of England.

This research addresses the potential for use of underground voids arising from aggregates mining in the UK and specifically the South East area of England. Table B 1.1 and Figure B 1.1 provide broad guidance on the possible after use applications of underground void, and an indication of their prevalence with the available depth of workings. The depths of intersections identified in the review of potential crushed rock aggregate geology undertaken as part of this work are all greater than 100m. According to Figure B 1.1, all uses other than energy orientated uses would be ruled out. It is stressed that while Figure B 1.1 is useful, as Ronka *et al.*, 1998 did not consider the utilisation of already constructed void (as would become available with underground aggregates mining) in their work, any after use being considered for a specific underground aggregates mine within the South East area of England will need to appraise the effect of the following key factors (at least) on project economics before deciding on whether a particular after-use is suited to the void or not.

B 1.2.1 Depth

For the depths of the aggregates prospects within the South East area of England, and for storage and warehousing applications, a key economic determinant will be the cost of raising the stored commodities from depth, as this may involve the consumption of significant quantities of energy (either in the form of fuel or electric power, depending on the mode of transport from the sub-surface), especially for storage of relatively low bulk materials such as grain, or gritting salt. In this context, energy is an analogue for cost.

Much depends on the specifics of the site. For example, in the hypothetical case of a mined void being created beneath the centre of a city with an after use as a fresh water storage reservoir, the costs of pumping the water from depth to a distribution centre within the city should be compared with the costs of pumping water from a location outside the city to the same distribution centre. Another factor that should be properly considered is that the capital costs of equipment and facilities for transporting bulk materials to and from the sub-surface (hoists, winders, conveyors, sub-surface rail, etc.) will have been considered, fully, as part of the initial aggregates development, and thus will not necessarily need to form part of the equipping capital expenditure associated with the after use.

In the case of non-bulk storage after use applications, where large masses do not need to be raised from the sub-surface, the depth dependence of energy consumption and thus operating cost is lessened.

B 1.2.2 Ventilation

During mining, the cost of ventilating a deep mine can represent up to 60% of the operating cost per tonne produced. The primary function of ventilation for mining is the sufficient provision of oxygen underground. This oxygen is clearly required for human respiration. The air requirements of a hard working human are 60 to 100 litres per minute with 1000 to 6000 litres per minute typically supplied. In contrast, diesel fuelled power plant for underground mining equipment require 4000 to 8000 litres per minute per kW of installed engine power. For modern mechanised mining methods and associated equipment, ratings of engines will be of order 100kW which clearly indicates that the dominant factor in ventilation system design will be the need to provide sufficient oxygen for combustion. These volumes of air are also required to dilute engine emissions (CO, CO_2, unburnt hydrocarbons and particulates) to levels safe for concurrent human occupation.

Clearly, provision of oxygen in the sub-surface is not the only reason for delivering large volumes of air underground. Gases introduced as a result of blasting practices and those that are naturally emitted from rocks and ground waters when excavation occurs also need to be diluted to protect the human working environment. Air is also delivered to reduce air temperatures to levels that can be comfortably tolerated by working personnel. Sources of heat in the subsurface include autocompression (1°C per 100m), geothermal heat (1°C to 3.5°C per 100m), internal combustion engines, electric vehicles and respiration.

The power consumed in mine ventilation is proportional to the cube of the flow rate. In any subsequent after use of the mined void, if a decision was taken to prohibit the use of hydrocarbon fuelled vehicles for underground transport, then the air flow rate requirements would be reduced significantly with accompanying reductions in the cost of ventilating the sub-surface.

In ventilating any particular airway within the sub-surface, the work delivered to the air by ventilating fans is used to overcome the resistance of the airway. The resistance of the airway is directly proportional to the airway length, meaning that deeper shafts will have higher resistance. However the airway resistance is also inversely proportional to the cube of the airway cross-sectional area, meaning that doubling the cross-sectional area of a shaft will reduce its resistance, and thus its fan power requirements, by a factor of 8. Thus, as far as ventilation costs are concerned, the dominant factor is the cross-sectional area of the shaft, not its depth. It is very costly to alter the geometry of a shaft once it has been developed, thus, if the value of the mined out area is more than the value of the mined product (as is the case in Kansas City, see B 1.1.1) and operational costs during the after-use phase dominate project economics, in mine development a decision may be taken to size shafts for the after-use phase, rather than the aggregate production phase—on grounds of cost.

For these reasons, the costs of ventilating the sub-surface during the after-use phase should be considered to be substantially lower than the costs of ventilating the sub-surface during mining operations (irrespective of depth of the shafts). It is possible that they will be closer to the cost of running HVAC systems in very large buildings or ocean liners. The capital cost of the ventilation systems of ample capacity for the after use phase will also have been considered as part of the original aggregates development.

B 1.2.3 Pumping

Water seepage sometimes occurs in the best planned and constructed underground areas and prevention measures can be costly and difficult to administer. In many former mines, controlling groundwater is an important aspect of mining operations. Water is usually present at some depth below the surface; and once encountered by mining, open crevices, fractures, and solution voids in the limestone may produce variable flows of groundwater. This inflow is routed along drainage slopes and ditches to collection places, usually a sump, from where it can be pumped from the mine. On occasions, a heading may intersect a fracture or void, which may release hundreds of gallons of water per minute. If the problem cannot be remedied, a portion, or all of the mine, may have to be closed.

However, it is very difficult to predict the requirements for the handling of ground water inflows at any site without full hydrological, hydrogeological and geotechnical investigations having been completed. This is exemplified by the case of the Norton Mine discussed earlier (see B 1.1.6); although well below the water table (which could possibly be well characterised *a priori* a mine investigation), the mine is said to be virtually dry. If new underground space were to be created for a specific use as indicated in Table B 1.1, then any economic decision would have to incorporate the full capital and operating costs of the sub-surface water management system. However, as an after use of already created sub-surface void, at least, the capital costs of pumping and water treatment equipment will have been sunk as part of the original aggregates mine development. By the time that the aggregates production operation has ceased, the ground water regime and the problems it presented would have been well characterised, such that the expected magnitude of pumping costs would be known reflecting lower after use project risk, even if these costs were substantial.

It is also worthy to note that should pumps be turned off during mine decommissioning, then workings that previously had to be pumped continuously will flood, and, most likely equipment that formerly kept underground workings dry could be permanently damaged. In these cases, the capital costs of pumps and other water handling equipment would need to be considered as part of the after use capital expenditure as well as the costs of dewatering the flooded mine. Depending on site specific conditions, the latter costs are known to be potentially so large that they have ensured that flooded mines that have been considered for reopening have remained closed. For these reasons, if an after use of a mine with known dewatering issues is being entertained, in order to minimise overall costs, at the completion of mining, the dewatering pumps should remain in operation while the hand-over to the after-use developer is effected.

Ongoing dewatering requirements may rule out certain after-uses, particularly relatively low economic value after-uses such as storage applications. Interactions of the proposed after use and the water environment would also need to be considered by the Environment Agency. The Environment Agency would undoubtedly require strong assurances regarding after use development proposals that may lead to groundwater pollution if not engineered and managed appropriately.

B 1.2.4 Type of Access

In Iowa, though more costly than quarrying, limestone for aggregate use has been extracted from underground mines (McKay & Bounk, 1987). The underground mining of limestone was necessary for a number of reasons, including where shallow rock units, which were once acceptable, no longer met newer engineering standards for construction aggregate. In these cases, most underground mines were opened from the floors of existing quarries. An entrance road or haulway was driven into the quarry wall or floor depending on whether the layers to be mined are at the same level as the floor or deeper. The depth of the mining level below the land surface varied between 23 m and circa 120 m. In deep mines, the primary crusher was located inside the mine, with the crushed rock moved via conveyor belt through an inclined tunnel to the surface where it is processed further, as at the Kaser Corporation's Durham Mine in Marion County (McKay & Bounk, 1987).

In the mining production models considered as part of this research, two distinct methods of securing primary access to the sub-surface were considered, referred to as adit access and shaft access. In the former case, a decline ramp was developed downward to the mining horizon and then a ventilation shaft was developed upwards and assumed to use raise boring methods. In both cases, no transition from quarry to underground mine was considered so both access types were assumed to start from an undisturbed surface horizon. Two hypothetical examples are used to illustrate the way that the type of access to the sub-surface may have a bearing on the choice of after use of the sub-surface void space created during aggregates mining:

If an underground car park is to be considered, underground aggregates mines that used shaft access would have to raise and lower parked cars in elevators. Large scale urban parking using elevator access for conventional multi-storey type parking facilities are commonplace in cities where urban space comes with such a premium that access ramps are uneconomical, for example Athens., but in those that used adit access, parked cars could enter and exit the sub-surface under their own motive power, driven by their owners (which may or may not be preferable), as is the case currently with multi-storey car parks.

For the deeper aggregates mine prospects considered that used adits, conveyors were assumed installed to transport (primary) crushed rock aggregate to surface, and thus could also be available for the transport of bulk commodities to and from the sub-surface for storage. For mines with shaft access, such commodities would have to be suited to transportation in skips.

B 1.2.5 Fire

As experience from the two major fires in the Channel Tunnel and fires in other major infrastructure tunnels have demonstrated, a fire in an underground area is difficult to extinguish. Confined conditions in geological environments make it very hard to dissipate heat which, unfortunately, prolongs fires, when they occur. Any after use considered for underground space will thus have to have detailed procedures for dealing with fires and a good sprinkler system is likely to be a minimum requirement.

B 1.2.6 Security

Underground space can provide improved safety and security for storage by offering protection from storms, accidents, arson and terrorism. It may also prevent ‘shrinkage’ (loss by theft).

B 1.2.7 Planning

Usage of underground mined out void carries with it complex issues but offers substantial planning and sustainability advantages. It allows large surface developments such as gas holders, warehouses and reservoirs, to be avoided, and mitigates the reduction in amenity and landscape impacts arising from the construction and operation of such surface structures.

Within the SE area of England, there may be appreciable resistance from the public and the planning authorities toward aggregates developments, especially if these involve developments on Greenfield sites. The so-called “Trojan Horse” argument could be advanced against any aggregates development, and there is no reason to think that an underground aggregates development would be perceived any differently. In the case of minerals developments on Greenfield sites in isolation, the “Trojan Horse” argument refers to the idea that not only is there fundamental objection to the aggregates development itself, but also to the principle of thereby creating Brownfield land and so opening a gateway to further (no doubt also potentially controversial) uses rather than reversion to previous use (for example, agricultural or forestry). Indeed, in order to secure permits to extract aggregates, the “Trojan Horse” argument can be used to preclude certain after uses or to cause the introduction of specific constraints or obligations on the reversion use of the land.

In terms of planning consents and environmental permits for aggregates mines, the surface constructions can be demolished, and the sites rehabilitated again to almost their original state and on the surface, the layout of roads and junctions are often changed with bridges widened and buildings enlarged. Shaft access mines may have to retain their headgear and winding house, however specific after-uses may require lower rating and lower performance shaft hauling equipment such that the head gear required for after-use operations is of lower visual impact than those used for aggregate production operations. For underground workings, refilling of a mined space cannot restore the original properties of the strata. The development of a mine is carefully planned in terms of access ways, maximum recovery of the mined material consistent with economical and safe working, and the control of stress conditions in the ground as the volumes of excavation increase. Underground, it is rarely possible to move an existing underground structure, and it is difficult to modify or enlarge it unless special provisions have been taken from the very beginning of the works. Where an after use has specific requirements of its accommodating structure, these requirements should be factored into the design of the aggregates extraction operation at the outset.

Future mining of aggregates in the South East area of England by their type and nature will mean that the location of the mines will be relatively limited. Their mining and the potential use of the space created may, therefore, require that a number of issues will have to be addressed. It is important to forecast the near-term and long-term uses of any underground project, and to plan these with more care than for surface projects. These issues are likely to centre on the careful integration of future mining activities with local and regional planning policies that are likely to increasingly require environmentally sound and sustainable land and resource use and development. To avoid negative views from the public on the utilization of underground facilities, the health, safety and psychological aspects of the planned structures should be given a high priority by planners when considering future use of the subsurface spaces (Sterling & Godard, 2001).

B 1.2.8 Fit-out and operational costs

Gentile, 1997, reports that the construction costs involved in the preparation of occupancy of most abandoned shallow mines in America are relatively inexpensive compared to surface facilities of comparable size. The ceiling, foundation, and supporting facilities already exist, so that preparing an underground area for storage or other use generally includes scaling loose rock from the pillars and ceiling, laying a floor of concrete or asphalt, applying a coat of (generally) white paint.

After uses where fit-out costs are more substantial proportions of total capital cost, such as hospitals or laboratories, are less likely to consider using underground space as the cost of construction of the accommodating structure forms a smaller proportion of the total capital costs. In contrast, in after use applications where the accommodation construction cost is dominant in the overall cost, such as warehousing or storage, economic considerations are more likely to result in the selection of mined-out void, if this can be secured cheaply, that is, at a price that is lower than the cost of construction of an equivalently sized accommodating structure on surface. The cost of the surface structure accommodating the use competes directly with the acquisition cost of a lease for the underground space for the same use.

The installation of fire control systems, electricity distribution, ventilation and pumping systems for control of heating, cooling, humidity and are major elements that must be considered within the capital costs of developing an underground facility for a given after use, taking account of whether the infrastructure originally installed for the mining operation can be reused.

However, aside from these capital expenditures, in general, for most after uses that could be considered, running the ventilation and pumping infrastructure services means that underground space will be more expensive to operate than space constructed on surface of equivalent scale. The exceptions to this rule may be when the surface space is itself very expensive to operate. These instances generally involve applications where environmental parameters need to be carefully controlled. The most obvious example of this is in the case of refrigerated spaces for food storage, where the cost of HVAC services for surface facilities may be comparable to the costs of maintaining these services underground. The extent of installed refrigerated space in the sub-surface beneath Kansas City is testament to this observation (see B 1.1.1).

B 1.2.9 Human perception of the sub-surface for mass occupancy uses

Although over 3000 people work underground in the Kansas City area (Gentile, 1997; Buzzbee, 2009), Sterling & Godard, 2001 report a reluctance to go underground for a large proportion of the population, with many people suffering apprehension and anxiety when having to use even a subway or an underground car park. Although many workers appear to prefer the underground atmosphere, some people suffer from claustrophobia and others have a psychological fear of going underground.

Factors which enhance the value of these voids for storage and other more minor uses described above (depth, location, minimal interaction with surface conditions, security) are, therefore, precisely those which are likely to engender negative public perception of the use of these spaces for purposes which require large numbers of people to spend relatively long periods of time deep underground.

If the experience in Kansas City is taken to be applicable to the population of the South East area of England, it would seem unlikely that aggregate mining void space in the South East area of England will find use as standard residential or office accommodation, or as retail premises. However, it should be noted that in 2007, over one billion passenger journeys were recorded on the London Underground transport network, and that for 4.17 million people in the South East area of England, access to the sub-surface is thus a routine, daily experience (Transport for London, 2007). This said, human perception of specific after-uses may ultimately dominate their acceptability and feasibility, especially for more controversial after-uses, such as those that may involve bulk human occupation (e.g. an underground shopping centre). To establish this in a definitive manner, research needs to be undertaken on what public and key stakeholder perceptions are of sub-surface void after-uses involving bulk human occupation.

B 1.3 Potential for use of underground space arising from the mining of aggregates

The type of space created and its suitability for after-use depends on the rock worked and the type of mining method used and the economics of the after use phase (which may or may not depend on depth for already constructed space). Modern room-and-pillar mining techniques for aggregate are likely to leave 25–50 per cent of the rock in the form of pillars to provide a permanent, stable support for the roof. The following sections briefly outline the expected potential uses of the mined voids.

B 1.3.1 Mass occupancy uses

Many countries utilise underground space for mass occupancy, with in the USA about 675 buildings being underground, either completely or to a significant extent (Hall, 2009). However, in terms of use of the space for human activities, for the depths of the mines that might be developed in the South East area of England, it is considered unlikely that potential mines of the future will be utilised first for living or mass occupancy work spaces.

Instead, niche mass occupancy uses requiring careful control of environmental conditions may be realised first. Many of these are leisure based uses that potentially also offer added value to developers. Examples include: swimming pools (temperature & humidity control), ice rinks (temperature control), saunas (temperature and humidity control), hypoxic running tracks (oxygen control), motocross tracks (noise control). It is useful to note that such uses of underground void are rather common in countries such as Finland and Canada where shopping centres or leisure facilities are located underground to afford protection from extreme winter climate.

Potentially more controversial or emotive mass occupancy after uses of underground space that would require extensive consultation with stakeholders and the general public in order to establish acceptability include:

- sewage plant operation, where there may be pollution concerns and pumping issues.
- cemeteries, where there also may be pollution concerns as well as emotive issues.

B 1.3.2 Agricultural produce and food storage

The storage of seasonal agricultural produce or agricultural activity itself is seen as a major area for development, because it offers large storage volumes of protected secure space, close to the point of consumption, potentially at comparable costs to surface facilities of a similar scale requiring controlled environmental conditions.

B 1.3.3 Bulk storage of munitions, documents or waste

The use of the void for bulk storage includes the archiving of documents in various media types, hazardous materials such as explosives and ammunition and general commercial warehousing. This type of void might also be considered for the storage of some types of hazardous waste (see Section B 1.3.7). It should be noted that storage of waste, explosives and munitions may raise serious public concern in the SE area of England and trigger determined opposition.

B 1.3.4 Compressed air energy storage

Renewable energy will become an important element of the UK energy mix with or without energy storage facilities, while the proportion of the renewables contribution remains less than ~30%. Thereafter, energy storage facilities may be required and onshore or offshore CAES facilities in aquifers and in lined and unlined mined voids could be developed to store off-peak renewable energy. Voids created during possible future limestone mining in Kent, for example, might be used for CAES, perhaps linked to renewable energy sources in the Thames Estuary area. Local CAES schemes could also facilitate distributed generation and micro grids around the UK.

B 1.3.5 Storage of liquid and gaseous hydrocarbons

Halite beds are absent from the South East area of England and so this form of storage for liquid and gaseous hydrocarbons will not be available. Instead, voids in other rock types including hard limestones or crystalline rocks are the most likely locations for energy storage. Abandoned mines (both coal and salt), unlined and lined rock cavities (LRC) also provide potential for the development of natural gas storage.

Large voids deep underground could therefore be possible sites for storage in the energy chain, including LPG and other liquid hydrocarbons providing the secure confinement of the product could be demonstrated. As is the case with the Chalk caverns at Killingholme, the hydrostatic pressure might provide the necessary confining pressures for safe storage.

From the viewpoint of surface and public protection of underground fuel storage, the most significant risk in gas or other fuel storage is the escape of stored product and the accumulation of flammable gases near the surface. Public safety has to be the top priority and in the UK the various Control of Major Accident Hazards (COMAH) and HSE regulations are designed to provide the framework for safe infrastructure above and below ground. Safety may have to be weighed against cost, which depends on the storage location relative to settlements, speed of the stock rotation and the nature of the products stored. When storing oil for strategic reasons (e.g. the American Strategic Petroleum Reserve), a loss of 1 per cent per year is a maximum value (Bérest et al., 2001). A propane storage facility in a remote area of Alabama, USA loses about 4 per cent of the stored mass of the caverns per year, yet is deemed economically viable and, importantly, safe in its setting (Bérest, 1989).

A comprehensive summary of the major problems encountered in underground fuel storage and the mitigation measures is provided by the reviews in Evans (2008, 2009). Public acceptability issues for these after uses should not be discounted and consultation exercises with stakeholders and the general public should be considered. Experience with planning applications elsewhere in England that aimed to store hydrocarbons underground in recent year suggests that this category of uses would be extremely controversial, and if associated with an initial proposal to produce crushed rock aggregate from the sub-surface, could significantly impede the underground mine permitting process.

B 1.3.6 Installation of large scale power plant and carbon sequestration

On the whole it is desirable to generate electrical power close to the point of its end use in order that the transmission and distribution losses to the end user consumers are minimised. However, proximity of living or working spaces to power plant is generally considered undesirable due to loss of visual amenity, potentially higher exposure to air borne or other pollutants resulting from the power production process, and other emissions such as noise. Locating large scale power plant in the sub-surface beneath electricity demand centres offers some advantages in these respects:

- Surface visual impact of structures is eliminated as the facilities are created in the sub-surface.
- The confined environment underground means that there is reduced chance of escape of air borne pollutants prior to scrubbing or sequestration plant.
- Any carbon sequestration schemes fitted to the power plant can deposit their products very close to the point of capture (i.e. by filling the workings) thus reducing cost.
- The product of the power plant itself (the electricity) is without mass and thus will not involve the consumption of energy in delivery of its product to the point of surface distribution.
- Delivery of the energy feed stocks (waste, biomass, coal, oil) to a deep level power plant may itself produce energy through, for example, regenerative braking (in the case of solid fuels conveyed to the sub-surface) or turbines (in the case of liquid fuels piped underground).
- Noise associated with the power production facility is confined to the sub-surface.

All electrical power plant adopting thermal technologies require cooling in order to operate. Locating a large scale power plant in the void created by underground aggregates mining beneath a populated area brings a large scale demand for heat (for heating or cooling) into proximity with a large scale supply of heat.

B 1.3.7 Hazardous waste disposal

Post-extraction uses of the voids created by mining activities might include the disposal of radioactive and other hazardous wastes. Winsford salt mine in Cheshire is currently used (see section B1.1.3) for the disposal of non-radioactive toxic waste and the Billingham anhydrite mine (which has been closed for about 30 years but is still de-watered) is being considered for the development of a facility for the disposal of incinerator residues. Other underground sites in the UK are also periodically considered for non-radioactive waste disposal and several have been trialled, including the Santon Ironstone Mines near Scunthorpe. Voids constructed during the mining of evaporate minerals such as salt, potash and anhydrite tend to be favoured for the disposal of toxic waste because of the low groundwater flows which usually prevail in these formations.

The disposal of radioactive waste in worked-out mines has not been considered in the UK since the early 1980s when the Billingham anhydrite mine was considered as a possible site for the disposal of intermediate level waste (ILW). In Germany, closed salt/potash mines at Asse and Morsleben have been used for the disposal of lower activity radioactive wastes, although water inflows at the Asse site led to the decision to recover all of the waste already deposited in this facility in early 2010.

If aggregate mining is carried out in such a way that the resulting excavations are appropriate for the eventual disposal of higher activity radioactive waste and if the rock types and geological environment are suitable to host a facility for the disposal of such waste, then a potential post-mining use of the workings might be the development of a radioactive waste repository. However, most national radioactive waste management organisations across the world are only considering purpose-built underground facilities for the disposal of higher activity waste. A key factor of current UK Government policy (Department for Energy and Climate Change, 2008) is that site selection for a radioactive waste disposal facility will be undertaken using a process of ‘volunteerism and partnership’ whereby a ‘community’ (see chapter 6 of the white paper for definitions) volunteers to host a facility. The community retains the right to withdraw from the process up to the point where underground operations and construction related to the disposal facility are about to begin.

In other words, if the local community does not want to host a radioactive waste facility, then, under current policy, such a facility will not be constructed.

B 1.4 Summary

Based on experience in the UK and elsewhere, a range of uses can be considered for the voids created in both active and inactive aggregate mines. Precedent practice in the (re-)use of underground void created by mining highlights a relation between depth and end-use, but specific sites must be considered on their individual merits and demerits for specific after-uses. The key factors that will affect the selection of after uses for mined out void include: depth, ventilation, pumping, type of access to the sub-surface, fire, security, planning, fit-out and operational costs, and human perception of the sub-surface (for possible mass occupancy uses). The public could well have views on all sub-surface uses and in many instances these may tend to being negative. To understand this, an urgent research priority is to quantify public and key stakeholder perception of sub-surface void after-uses.

The most likely initial uses of underground space or voids created by aggregate mining foreseen will be for storage purposes. This will be in the main bulk commercial or archival storage, both requiring controlled environments, and for the storage of waste materials. In the longer term, after uses may extend to energy storage applications, in the form of compressed air and possibly liquid or gaseous hydrocarbons (however the latter may be particularly controversial with the public.

Increasingly, there will be a need to design the underground aggregates extraction operation taking the fit-out, equipping and operating costs of the after use into account at the outset.

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix C

Land values, rental rates and development costs, by end use and region

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

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C 1 Land values

These are relevant to the purchase of land at the time of the aggregates development, whether this be for surface quarries or underground aggregates mines. In addition, these values are relevant to the sale value of remediated land, created after the mine or quarry has been decommissioned.

In the UK there is no general state ownership of mineral rights. Exceptions to this are energy minerals (oil, gas and coal) and precious metals (BGS, 2009). Mineral resources are mainly in private ownership although some may be owned by the Crown and by Government departments and agencies. Therefore, land on or under which aggregates are to be extracted has to be owned by the aggregates operating company if they seek the rights to work the mineral. Alternatively the aggregates operator can take a lease from the freehold owner of land, but then it must effectively pay a royalty. In case of underground aggregate mining the reduced surface footprint of such operations in comparison to surface quarrying operations, could provide an opportunity for concurrent use of a freehold it owns where the underground workings extend beyond its surface footprint and hence enhanced revenues during extraction operations.

The realisable value of land, if land is to be sold once the aggregates operator has completed extraction, is dependant on its future use. Several land uses are considered in the valuation models: agricultural, residential, industrial, commercial and retail. Land values vary per region and are influenced by the principle of supply and demand. Values used in this research are based on data from the Property Market Report published in 2007 by the Valuation Office Agency (VOA, 2007). Data for each of the intended uses are presented for all regions within the UK. Where necessary, these data have been processed or manipulated to fit with the units of measure used in the aggregates valuation procedures (e.g. conversion of value per m^2 to hectare). These processes and the assumptions made during these manipulations are explained in this section.

C 1.1 Agricultural

Agricultural land can have many uses. It can be used for growing crop, grazing dairy cows or other livestock or a mixture of both. The geographical location and features of the terrain can affect land value too. Given the range of factors affecting agricultural land values, an average value per hectare has been calculated considering arable, dairy, mixed or inclined (hill) grazing use. Land for agricultural use is assumed to be sold un-equipped. This means the typical farm is split so that the land is sold without the benefit of any residential accommodation or farm buildings (VOA, 2007).

C 1.2 Residential

Land intended for residential development has a higher value, based on the potential higher yield (rate of return) from the developed property. Regional residential property prices vary appreciably in the UK. The use of national average figures may undermine an otherwise legitimate inter-regional comparison. Residential building land values are retrieved from the Property Market Report for each region. The data are based on the average selling price for each region and should be regarded as indicative. Furthermore they represent typical levels of value for sites with no abnormal site constraints and a residential planning permission of a type generally found in the area (VOA, 2007). Two types of land are covered in this report: small sites, with enough land for less than five houses and bulk sites, in excess of two hectares, suitable for any given residential development. The land is assumed to be typical for the region and to have planning permission.

C 1.3 Industrial

Land values for industrial or warehouse developments are also retrieved from VOA, 2009 and represent regional average values. Different industrial uses are reflected by a spread of land values which can be found therein. As no specific industrial uses are considered for land to be sold, in this study, the regional average is used for modelling purposes.

C 1.4 Commercial

Commercial land uses are those development types that do not rank in the other land use categories considered. Potential uses are office buildings, non-shopping centre shops and other commercial non-domestic uses. The value of land for commercial development is assumed to be equal to the value of industrial building land.

C 1.5 Retail

The value of land to be sold for development for retail purposes that is used in this work, is calculated from rental values and corresponding yields (rates of return). The yields are quoted in the Property Market Report (VOA, 2009) as the all risk yield. This yield is calculated by dividing the annual rent, as though it had been received as a single sum at the year end, by the capital value or sale price of the property (VOA, 2007). Effectively this represents the rent as percentage of the capital value. These yield data are based on modern, standard sized shop units located in a prime location (either town centre or shopping centre). Using rental rates (see Section C 2) the capital value for a standard shop is calculated. The standard shop has a 6.1m frontage, is 18.3m deep and has 30 m^2 of storage or staff accommodation. The total unit area sums up to 142 m^2. The capital value is calculated by dividing the unit rent by the yield. In converting capital values per square metre to values per hectare space has to be allowed for surface infrastructure like roads, walkways and parking lots otherwise this would result in an overestimation of the land value. Analysis of shopping centre plans showed that except for inner city locations, roughly 30 % of the developed area is used for building the actual mall. The actual area of shop floor is even further reduced as, within the shopping centre, space is reserved for walkways, shop supply routes and communal facilities like lavatories.

Table C 1.1: Average Land values per Region

	Agriculture	Residential		Industrial	Commercial	Retail
Region	Average £/ha	Small Sites £/ha	Bulk Sites £/ha	Average £/ha	Average £/ha	Average £/ha
North East	4,940	2,840,000	2,590,000	167,000	235,000	8,607,769
North West	7,155	2,970,000	2,880,000	470,000	620,000	6,493,046
Yorkshire & Humberland	6,402	2,940,000	2,550,000	641,000	844,000	8,434,655
East Midlands	8,831	2,370,000	2,190,000	450,000	588,000	6,981,560
West Midlands	6,346	2,500,000	2,350,000	568,000	667,000	7,632,250
Eastern	7,956	3,790,000	4,200,000	1,119,000	1,369,000	7,414,600
South East	8,764	3,950,000	3,830,000	1,499,000	1,676,000	8,101,945
South West	7,997	3,150,000	2,690,000	717,000	848,000	7,661,226
Wales	3,459	2,630,000	2,520,000	236,000	302,000	5,292,091
Inner London		12,020,000	9,825,000		2,810,000	12,258,154
Outer London		7,580,000	6,990,000	2,285,000		8,399,053
Scotland	4,458	2,010,000	2,140,000	296,000	664,000	5,648,316

C 2 Rental Values

The land owned by the mining company can be rented out to a third party during active extraction of aggregates, particularly if an underground method is applied. Assuming a sufficient factor of safety is allowed for in the mine design, all land uses mentioned earlier can be considered to be suitable for concurrent use. Data on rental values per region have been taken from several sources. In case of non-existent data, rental values have been calculated or estimated from yield and capital data. In the next paragraphs the calculation method and assumptions for each land use are presented.

C 2.1 Agricultural

Agricultural rental values are linked to income of the land rather than land values. Rented development values therefore represent the capability of the rented land to generate income. However, land with reduced production is generally sold at a reduced price and some relation between rental value and land value can therefore be assumed. Average rental values are used as a parameter in DEFRA's Observatory Monitoring Framework (DEFRA, 2009a). In the Indicator Datasheet for Indicator B5 (DEFRA, 2009b), the average agricultural rents are given. Agricultural rental agreements considered in this report, are assumed in accord with the Agricultural Tenancies Act 1995 and are classified as Farm Business Tenancies (FBT) (VOA,2007). Figure C 2.1 presents FBT rental data taken from DEFRA, 2009a. This data represents UK average rents. A correction factor has been calculated by dividing the regional agricultural land value by the national average agricultural land value. Regional rental values have been estimated by adjusting the national average rental values by the regional correction factor.

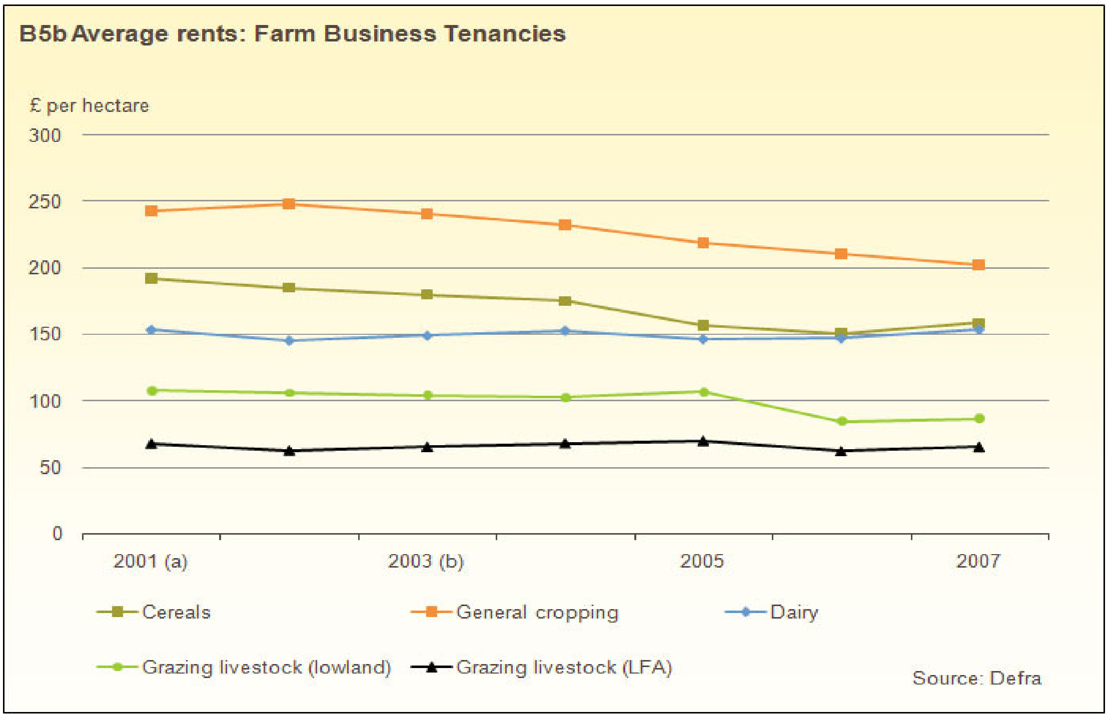

Figure C 2.1: Farm Business Tenancies (from DEFRA, 2009a)

C 2.2 Residential

Rental values for residential property are calculated from the developed capital land value using an average yield of 5% (Hunt *et al.*, 2007).

C 2.3 Industrial

Industrial rental values per hectare are calculated from data retrieved from the Valuation Office Agency's 2007 Property Market Report (VOA, 2007). In this report rental values for five different types of industrial buildings are distinguished, ranking from small units (25 to 75m^2) to large individual units. From this data an average industrial rental value is calculated. Although industrial buildings in general are large, seldom do single units cover a hectare or more. In industrial development an estimated 50% of the surface area is actual rented property, with the remainder for parking spaces, roads, walkways and other public infrastructure. In adopting this coverage factor, an average industrial rental value per hectare can be estimated for each region.

C 2.4 Commercial

Commercial rental values cover a large number of potential uses and are therefore not easily deducted. Office rents are about two to four times higher compared to typical industrial rents. Commercial rents are estimated by multiplying industrial rent values by a factor three.

C 2.5 Retail

The Government's Valuation Office Agency 2007 Property Market Report (VOA, 2007) presents data on rental values for different types of shops for all regions in the UK. From those data an average rental value is calculated for each region. Using the same assumption as described in the section on land values, nine 142 m^2 shops are on average developed per hectare. Multiplying the average rental value per square metre with the average developed shop area of 1,278 square metres, results in a rental value per hectare for each region.

C 2.6 Summary of average rental values per region, by use

Table C 2.1: Average Rental Values per Region

	Agriculture	Residential		Industrial	Commercial	Retail
Region	Average £/ha	Small Sites £/ha	Bulk Sites £/ha	Average £/ha	Average £/ha	Average £/ha
North East	107	216,429	516,349	246,000	738,000	2,076,750
North West	155	223,788	518,854	273,631	820,893	1,603,890
Yorkshire & Humberland	138	214,727	455,095	307,375	922,125	2,006,460
East Midlands	191	186,885	436,183	278,333	835,000	1,680,038
West Midlands	137	201,500	490,610	279,375	838,125	1,840,675
Eastern	172	280,542	673,892	351,389	1,054,167	1,788,881
South East	189	296,750	719,487	447,026	1,341,078	1,830,309
South West	173	239,458	584,603	334,886	1,004,659	1,767,416
Wales	75	206,813	485,700	232,813	698,438	1,390,624
Inner London	0	708,500	1,454,597	575,208	1,725,625	3,004,283
Outer London	0	506,321	1,025,271	501,042	1,503,125	2,125,367
Scotland	95	177,679	545,975	292,347	877,042	1,374,809

C 3 Development Land Value

Acquired land might be developed into properties to let. This development comes at a cost. In this section the development costs for each proposed land use are discussed.

C 3.1 Agriculture

Agriculture is a relative low value land use. Although farmland might be upgraded to improve crop yield, the capital investment required can be considered irrelevant. Derelict mine or industrial sites can be converted into agricultural land. The costs related to these operations are however not considered development costs, but reclamation costs which are included in the de-commissioning and aftercare cost models.

C 3.2 Residential

Table C 3.1: Residential Unit Property Value

Development Unit Cost Region	Terraced House (modernised) £/unit	Semi Det House (modernised) £/unit	Semi Det House £/unit	Detached House £/unit	Flat Storey Block £/unit
North East	150,786	182,143	163,429	297,714	118,286
North West	136,925	185,050	172,075	301,150	112,618
Yorkshire & Humberland	120,318	161,364	152,727	270,909	97,045
East Midlands	115,083	154,833	146,542	273,542	100,021
West Midlands	140,900	173,000	161,700	306,000	113,350
Eastern	186,250	215,417	194,583	364,167	140,000
South East	207,567	243,667	227,067	397,000	162,000
South West	170,091	205,250	202,417	327,833	140,458
Wales	126,719	175,500	166,438	301,250	108,438
Inner London	510,944	507,500	235,000	430,000	302,300
Outer London	266,429	308,571	297,143	509,286	206,429
Scotland	185,750	205,964	174,714	308,714	134,357
Dwellings per hectare	50	25	25	16	150

In the residential development cost estimation process, it has been assumed that the value of the constructed property reflects the cost of development, excluding the cost for land purchase. In the

Government Valuation Office Agency's 2007 Property Market Report (VOA, 2007) regional valuations for the specific property types are given. These valuations represent typical locations and developments within the given area.

For the purpose of comparison, an average unit property value per region is derived from the data. Small sites are defined to have 5 or less properties developed, while bulk sites are defined to have a minimum area of two hectares, with no restrictions on the number of dwellings per hectare developed. Development costs for bulk sites are calculated from the development cost for each property type per hectare, based on a dwelling density of 50 dwellings per hectare (dph) for terraced houses, 25 dph for semi detached houses, 16 dph for detached houses and 150 dph for flats (RIBA, 2006). The average of those values again represents the development cost per hectare for bulk sites as presented in Table C 3.2.

C 3.3 Industrial

Industrial property development costs are calculated based on rental and capital values as described in the previous paragraphs. The development costs are reflected by the estimated market value of the developed property minus the land value.

C 3.4 Commercial

Commercial land values are approximately the same as industrial land values. Commercial rents however are a factor three higher compared to their industrial counterparts. Yields for commercial developments, like offices, are roughly 0.5% lower than industrial yields. The higher rents are therefore explained by high development costs. The capital value of commercial property can be estimated by dividing the typical rent by the yield. Finally the development costs are estimated by subtracting the land value from the capital value of the property.

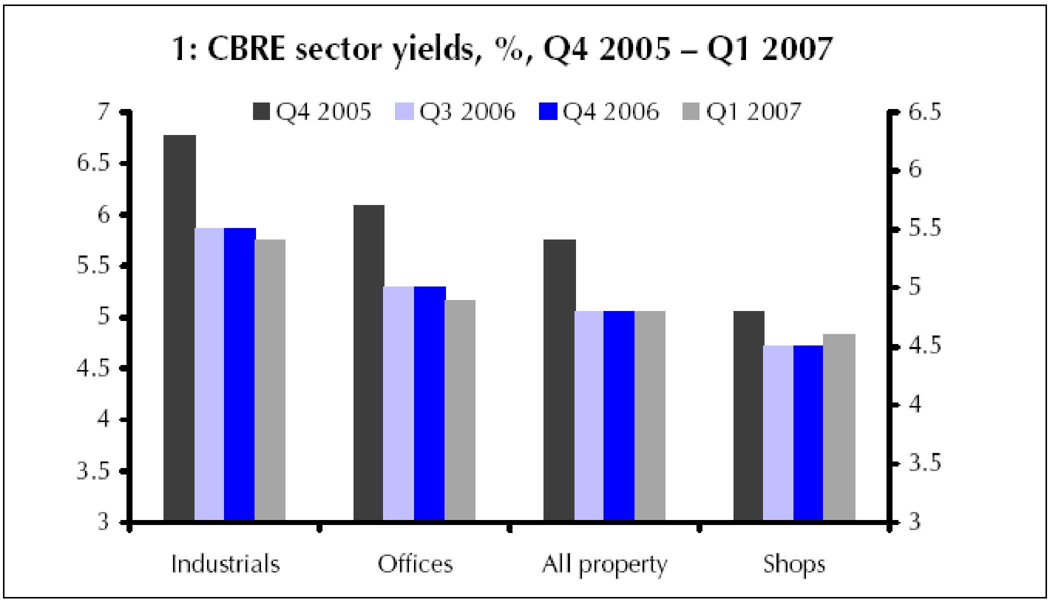

Figure C 3.1: Typical Yield (Bootle,2007)

C 3.5 Retail

The estimation process of retail development costs is comparable to previously described cost estimation processes. The average capital value per unit is calculated. From these data, the average yield for each region is calculated. Calculating with an average of 9 units per hectare, the total capital value per hectare is retrieved. The development costs per hectare are assessed by subtracting the land value from the total capital value per hectare. Typical retail development costs per region are given in Table C 3.2

Table C 3.2: Average Development Cost per Region

Region	Agriculture Average £/ha	Residential Small Sites £/ha	Residential Bulk Sites £/ha	Industrial Average £/ha	Commercial Average £/ha	Retail Average £/ha
North East	0	1,488,571	7,736,971	2,867,500	13,183,182	20,084,794
North West	0	1,505,750	7,497,084	2,143,869	14,305,325	15,150,441
Yorkshire & Humberland	0	1,354,545	6,551,909	2,675,250	15,921,909	19,680,862
East Midlands	0	1,367,708	6,533,667	2,201,042	14,593,818	16,290,306
West Midlands	0	1,530,000	7,462,200	2,181,375	14,571,636	17,808,583
Eastern	0	1,820,833	9,277,833	2,456,833	17,797,667	17,300,733
South East	0	1,985,000	10,559,733	4,261,508	22,707,242	18,904,537
South West	0	1,639,167	9,002,059	3,326,750	17,418,529	17,876,195
Wales	0	1,506,250	7,194,000	2,083,531	12,396,864	12,348,213
Inner London	0	2,150,000	19,266,944	6,682,292	28,565,000	28,602,358
Outer London	0	2,546,429	13,515,429	4,252,500	24,519,545	19,597,790
Scotland	0	1,543,571	8,779,493	2,829,556	15,282,212	13,179,404

C 4 Private Finance Initiative (PFI) estimates of development cost and rental

HM Treasury data on the capital value and schedule of unitary payments for Private Finance Initiative (PFI) projects were adopted to establish a land values database for use in the valuation computations (HM Treasury, 2009). Where the financial close year did not correspond to 2007, the PFI data were adjusted for the effect of inflation using ONS cost and price indices (ONS, 2009). The values for PFI projects were taken to apply across all regions.

Table C 4.1: Selection of development costs and rental values for civil projects based on PFI data

Project	Name	Project Life (years)	CAPEX, 2007 (£M)	Rent, 2007 (£M/year)	Land area (est) (ha)	CAPEX (£M/ha)	Rent (£M/ha/yr)
STW	Highland STW	23	41.18	9.01	6.00	6.86	1.50
STW	Daldowie	24	86.59	17.49	17.50	4.95	1.00
STW	Dalmuir	25	39.11	8.15	3.48	11.24	2.34
STW	Aberdeen	30	90.81	17.16			
STW	Meadowhead	31	73.15	13.98			
Average for STW					**8.99**	**7.68**	**1.61**
Barracks	Wattisham	25	15.15	4.26	4.59	3.30	0.93
Barracks	Colchester	35	586.42	66.10	185.00	3.17	0.36
Barracks	Allenbury/Conna	35	1297.81	261.36	1240.00	1.05	0.21
Average for Barracks					**4.59**	**2.51**	**0.50**
Courts	East Anglia	25	28.48	5.93	0.588	**48.43**	**10.09**
Waste2Energy	Baldovie	20	54.78	3.16	3.75	**14.61**	**0.84**
Leisure	Uttlesford	32	6.61	0.96	1.38	4.79	0.70
Leisure	Willesden	25	17.72	2.05	1.6	11.07	1.28
Leisure	Downham	32	18.76	1.92	1.35	13.89	1.42
Leisure	Breckland	32	15.95	2.00	1.4	11.40	1.43
Average for Leisure					**1.43**	**10.29**	**1.21**
Office Refurb	GOGGS West	35	168.25	19.15	3.40	49.48	5.63
Office Refurb	MOD	30	523.83	94.34	8.60	60.91	10.97
Office Refurb	Home Office	29	427.88	52.32	5.40	79.24	9.69
Office Refurb	GOGGS	31	197.87	21.15	4.00	49.47	5.29
Average for Government Office Refurbishment					**5.35**	**59.77**	**7.89**
Prison	Cookham Wood	15	10.08	9.79	3	3.36	3.26
Prison	Bronzefield	25	48.98	22.68	12	4.00	1.85
Prison	Peterborough	25	75.43	28.68	27	2.80	1.07
Average for Prison					**14.05**	**3.39**	**2.06**

The land areas for each project were estimated by identifying the facilities with virtual site visits using Google Earth and measuring the development site area where possible. These produced specific capital expenditure values and development rental incomes with the same units (£/ha), (£/ha/annum) as were developed for the more generic land use types set out earlier. Hence capital expenditure and rental values drawn from this data base could be used to explore specific after and concurrent uses of land in the valuation models. Remediated mine and quarry sites are frequently identified as suitable for civic or public sector projects, that are not reflected in the land and rental values presented earlier.

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Underground Mining of Aggregates Appendix D

Cost Model Assumptions

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D 1 Introduction

This appendix presents details of the assumptions and processes that have been adopted to establish the cost models that have been developed and applied in the research.

Detailed cost models have been established for:

- Aggregates quarries operating in the UK at four distinct scales of production, ranging from 1,500 tonnes per day to 14,000 tonnes per day (375,000 tonnes per annum to 3.5 million tonnes per annum).
- Underground aggregates mines operating in the UK, at a depth of up to 1,000 metres below surface, adopting either the room-and-pillar or long hole open stoping method of working, at four distinct production rates ranging from 1,500 tonnes per day to 14,000 tonnes per day, accessing the sub-surface either by a 10° decline or by means of a vertical shaft, where development of this primary access could be through either wet or dry geological sequences.
- Processing plants, operating in the UK, that crush, screen and sort aggregate product into marketable grades of stone, at four distinct scales of production ranging from 1,500 tonnes per day to 14,000 tonnes per day.

The choice of production rates at which the various models apply was informed by a survey of UK quarrying practice conducted through review of a database of quarry operational reports held within the library archive of the Camborne School of Mines. The same set of production intensities were adopted for the underground mining method cost models and the processing plants, in order to facilitate comparison between the options and to ensure that the total production costs of aggregates production could be identified.

The materials in this appendix open with details of assumptions and processes applicable to all of the models. Then assumptions and processes are explained that are specific to the quarry, underground mines and the processing plant are set out in separate sections. The materials close with a guide to interpretation of the structure of the detailed cost model data presented in the remaining appendices, E to H of this report.

D 2 General assumptions

The quarry models and the underground mine aggregate models only consider the production of crushed stone, up to and including the primary crusher. All costs related to processing this raw material to convert it into a saleable product are captured in the processing cost models.

The models include capital costs for buildings, equipment and site development. Costs related to planning, permitting and commissioning are not included in these production cost models as they may be site specific, but these are considered later in the process of comparing underground aggregates production with surface quarrying. Costs related to environmental mitigation, decommissioning and aftercare are not included either as these are considered specifically elsewhere within the research. All models are assumed to be producing in the UK, working competent deposits with sufficient resources to cater for a production life of at least twenty years, even if actual production lives considered in later parts of the research are shorter than this.

D 2.1 Exchange rate

Price data is derived from a costing handbook providing data in US dollars. These data has been converted to pound sterling with use of a 2006 year average exchange rate of 0.543 Sterling Pound per US Dollar (Go Currency, 2009).

D 2.2 Annual Working Days

In all production scenarios extraction is undertaken five days per week, with (occasional) maintenance and site cleaning during nightshift or on Saturdays. No work is undertaken during 8 bank holidays per year. Two days per annum are taken into account for unplanned maintenance, resulting in 250 annual working days. In the quarry models one production shift is considered per day. Underground mines are less constrained in working hours compared to their surface counterparts. Therefore two working shifts per day are assumed in the underground methods. Two shifts have been considered in all the processing model specifications.

D 2.3 Site Procurement

Costs for procuring sites are not included in the initial model for several reasons. Quarries and mine sites commonly are developed in rural areas where land values are likely to be low compared to the total capital costs. The models are developed to be applied in the evaluation of multiple sites, which may not be in the same region and costs of land procurement may be considerably different in each UK region. Land procurement is therefore considered in the evaluation / optimizing tool used later in the research, rather in these sections that concern specification and costing of aggregate production.

D 2.4 Operating costs

The operating costs for the models comprise the costs for spares, maintenance, labour, diesel and electric power consumption, explosives consumption and remaining consumables. These cost headings are calculated using the effective annual operating hours for each piece of equipment. Annual operating hours are determined by the number of annual working days, the number of worked shifts and the work time per shift. A utilization factor of 83% has been used to calculate the effective operating hours (Kumar, 2007). Both diesel fuel and electrical power consumption are related to engine or motor ratings. In order to obtain a reasonable estimate of both power and diesel consumption the consumption rate as retrieved from the database of standard costs is multiplied with the effective annual operating hours. Electrical power consumption is corrected for peak draw by applying a load factor of 60% to total installed power.

D 2.4.1 Spares

Equipment is subject to wear and tear. Spares are needed for regular maintenance. In the mining cost models the spare parts are calculated using a hourly cost price derived from the Western Mine's Mine and Mill Equipment Costs Estimators Guide (Western Mine, 2006a). This hourly cost is multiplied by the operational hours and corrected utilization factor. The sum of all spares costs for all employed equipment represents the total cost for spares.

D 2.4.2 Tyres

The cost related to tyre wear is not readily assessed. Working conditions can vary considerably depending on rock type and blasting characteristics. In this study tyre wear is assumed to be moderate (Caterpillar, 2000). Tyre sizes used on large mining equipment are not common day products. Only a limited amount of tyre manufacturers supply the market, resulting in relatively high prices. Over the last few years demand for tyres has been outweighing the supply with long lead-times. At present, prices are under pressure by reduced equipment sales and mining activity. The cost estimation used for this study is based on data from Western Mine's Mine and Mill Equipment Costs Estimators Guide (Western Mine, 2006a) and Caterpillar (Caterpillar, 2000). Prices may however be variable due to market conditions and bulk sales discounts (Western Mine, 2006a).

D 2.4.3 Explosives

All considered mining methods use drill and blast. The total explosives consumption depends on the mining or quarrying method and characteristic powder factor. Detailed blast design calculations have been made each model in order to estimate the total explosive consumption.

D 2.4.4 Production labour

The number of hourly employed personnel relates directly to the number of different items of equipment operated and the number of shifts per day. In the long hole open stoping mining method two levels are worked. This involves more equipment and thus more operators are employed.

D 2.4.5 Maintenance labour

The number of maintenance fitters employed to keep the fleet of mobile plant in good running order is specified in the models calculated from figures on the required maintenance per operated hour for each item of equipment. The total required annual hours of maintenance is worked back to the number of Full Time Equivalent (FTE) fitters employed. For underground operations, a small service crew maintaining the underground infrastructure is also assumed to be employed. This crew is assumed to consist of 2 operatives in the lowest production rate and ranging up to 6 operatives in the highest production rate scenarios.

D 2.4.6 Office staff

In the mining models no office staff are included as the operation is considered to be operated by a large corporation or company with a central office taking care of administration.

D 2.4.7 Management

In all the production models, a mine manager is assumed to be in charge of the operation. For underground aggregates mines this person will be assisted by a foreman on the nightshift in 1,500 and 2,500 tonnes per day production scenarios. For the 5,000 tonnes per day mine production scenario a foreman is employed for each shift. In the 14,000 tonnes per day production scenario the size of the operation is as such that the mine manager is assisted by an underground superintendent, who at his turn is supervising two foremen. In all but the 1,500 tonnes per day production scenarios, an engineer is employed directly on site. For the quarrying operations the mine manager is assisted by two foremen only for the 14,000 tonnes per day operation.

D 3 Underground cost models

The requirement for supported underground mining methods restricted the specifications for underground mining operations to the room-and-pillar and the long hole open stoping mining methods. For each of these two methods of primary access are considered. The first scenario deals with vertical shaft access and the second with access by means of a 10° declined adit (decline). Each method and access type is modelled for the same production rates as for the quarry models. For all the considered scenarios a wet and dry option has been established. The difference in the two models is in the cost for shaft sinking and the required pumping. Although water can have important impacts on ground stability, wet working conditions are not assumed to have a major impact on the design of stoping operations. The depth of the worked seam is considered to be up to 1000 meters below surface.

D 3.1 Capital costs

D 3.1.1 Primary access development costs

As shaft or decline sinking costs form a large part of the total capital costs, a detailed model for these that accounts for varying production rate and depth has been established and presented in Section D 3.2. In the development of underground aggregates mine specifications for computation of the capital costs, a working depth of the shaft or adit of 150 metres has been assumed to permit consistent summary costs for capital and operating costs to be presented. When applied to specific prospects identified during the research the depth of potential aggregates intersections varies. Thus, when the optimum mining method and production rate is computed for specific prospects, the capital costs of the 150 metre deep adit or mine considered herein are subtracted from the total capital costs, and the costs of primary access to the specific prospect intersection depth are computed and added back. This means that for the economic studies, the capital costs used are fully sensitive to the planned depth of mining.

D 3.1.2 Underground Mining Equipment

The relatively large cross-sectional area of a decline allows for large equipment to be transported into underground mines. Modified surface equipment might therefore be employed underground, resulting in reductions in capital costs, compared to the use of specialized underground mining equipment. In case of shaft access underground equipment sizes (or modularised components thereof) can not exceed skip dimensions so relatively specialized and more expensive underground equipment is thus specified.

All equipment is assumed to be owned and operated by the mining company. After reaching its expected useful life the equipment is assumed to be replaced. In practice all major equipment would be overhauled and brought back in production. However lifetimes after overhauls are reduced thus assuming replacement may result in broadly similar overall equipment costs.

The types of equipment used in the room-and-pillar mining method and the long hole open stoping mining method are broadly similar, involving wheel loaders and dump trucks for loading and hauling. An important distinction between the methods in the specification of drilling rigs; in room-and-pillar mines, rubber tyred, twin boom drilling jumbos are specified whereas single boomed drill rig similar to that used in surface quarrying is specified for the long hole open stoping method.

For face charging an underground ANFO loader is assumed to be used. Although the roof is assumed to be formed by stable solid rock broken along natural geological partings, a rock-bolter is assumed a useful addition to the mine's fleet. In case of a decline access a grader has to be used for decline maintenance. A decline access permits larger sized equipment to be brought into the mine, and these typically have lower emissions rates that reduce ventilation demands. The size of the equipment is scaled against the production requirements and selected such that each piece of equipment matches the load and hauling system. Underground people transport is assumed to be done by means of pick up trucks, which are used for servicing equipment at production faces too. The number of vehicles in use is proportional to the number of faces in use and the number of staff. In all scenarios the mines are assumed to relatively dry, with limited need for pumping. The required pumping capacity is estimated by use of the SME Mining Engineering Handbook (O'Hara, 1992).

D 3.1.3 Site Development

The surface land area footprint of an underground mine is less compared to a surface quarrying operation with the same production rate. The surface facilities for underground aggregates mines that need to be erected include change rooms, offices, surface workshops, stores and some other amenity buildings. In the case where a shaft is being used, a hoisting room and shaft block are also needed. Site clearing will have to take place before shaft sinking or decline driving can start. Sinking, or driving the primary access opening (e.g. shaft or decline) to depth of 150 metre below surface may take up to one-and-a--half years. According to British mining law each underground working should have two access routes. For this reason and for effective mine ventilation, each individual model is includes a 4 metre diameter vent-shaft with man access.

D 3.1.4 Room-and-pillar mine development

Underground development (i.e. creation of tunnels, drives and adits, etc. in order to access ore) is limited as the mine will be operating in “ore” and all the mined material forms part of saleable product. Underground workshops, possibly sumps and storage facilities are needed, but are assumed to be created in mined areas and are therefore not considered to be part of the capital investment of developing the mine. For all the production scenarios the primary crusher is assumed to be installed underground. The cost of the crusher room and all installations is assumed to be 7 times the initial investment of the crusher to be installed (O’Hara, 1992). In the shaft models the crushed material is hoisted to the surface by means of a skip-hoist installed in the shaft. In the decline models the material is assumed to be transported to the surface by means of a belt conveyor, which is installed in the decline.

D 3.1.5 Long hole open stoping mine development

Before stoping can start, both the sublevel and the haulage level have to be developed. Full production rates are only achievable later in the production life of the mine, in comparison to room-and-pillar methods, when a relatively constant number of multiple underground open stopes are able to be maintained through development advance. The minimum length of drives to be developed is calculated based on a simple stope lay-out with 50 metre long rib pillars. The resulting tonnage of development product is given in the model.

D 3.1.6 Summary of Underground Mining Capital Costs

Table D 3.1 sumarises the total capital costs for all the underground production models. A full breakdown of these costs is provided in Appendix E for room-and-pillar and Appendix F for long hole open stoping.

Table D 3.1: Total capital costs for underground mine models

Underground Capital Cost						
Daily Production			1,500	2,500	5,000	14,000
R&P	Shaft	wet	25,249,792	35,225,245	48,893,965	69,188,899
		dry	22,151,939	32,164,908	45,673,292	65,912,381
	Decline	wet	36,032,448	43,909,037	56,671,845	57,925,868
		dry	30,929,595	38,743,700	50,346,172	52,644,350
LH	Shaft	wet	34,038,519	57,200,363	84,249,831	113,205,359
		dry	30,940,664	54,140,028	81,029,161	109,560,639
	Decline	wet	39,861,424	56,318,177	77,930,383	92,580,965
		dry	34,758,573	51,152,843	72,645,969	87,188,254

D 3.2 Shaft development

Shaft development cost can be the most significant component of underground mine capital expenditure (>50% of total capital expenditure for a 14,000 tonnes per day underground mine with shaft depth ~600m), and thus the model used to estimate these cost is set out in full within this section. The method reported in the SME Mining Engineering handbook (O’Hara *et al.*, 1992) is a frequently adopted estimation method for shaft development costs. However it is fully empirically-based and also somewhat dated. Consequently effort was allocated to upgrading the O’Hara model so that at least the variable cost component, that is the depth dependent cost component, could be estimated with improved confidence. The estimation model was rendered suitable for the current purposes by:

- allowing recent input costs for labour, explosives, grout, etc to be used,
- rendering the model sensitive to varying shaft geology, and;
- rendering the model it sensitive to sinking through wet measures, by means of varying the advance rates, allowing for probe hole drilling, grout hole drilling and modelling grout consumption explicitly.

In the shaft development cost estimation model set out, fixed cost components, such as head gear and shaft equipment, were estimated using O'Hara's methods. These costs were estimated originally in 1992 US$, converted to 1992 £ using currency exchange rates applicable to 1992, and then these were corrected to 2007 terms by use of cost indices for construction projects sourced from Langdon (2006). Input costs for the depth dependent cost models applied for 2007 directly.

The total capital cost of developing a shaft, C_{shaft}, is:

$$C_{shaft} = C_{sink} + C_{hf} + C_{equip}$$

where:
- C_{sink} is the cost of sinking operations,
- C_{hf} is the cost of the head frame of the shaft and its winder,
- C_{equip} is the cost of equipping the shaft with skips, mancages, ropes, guides, pipework, etc.

The cost of sinking operations comprises:

$$C_{sink} = C_{grout} + C_{drill} + C_{expl.} + C_{labour} + C_{lining} + C_{facilities}$$

where
- C_{grout} is the cost of grout used to create an impervious seal around the shaft to prevent the ingress of water (where necessary),
- C_{drill} is the cost of drilling required,
- C_{expl} is the cost of explosives,
- C_{labour} is the cost of labour used to develop the shaft,
- C_{lining} is the cost of procuring and emplacing concrete to create a permanent internal lining,
- $C_{facilities}$ is the fixed cost of surface facilities such as a concrete plant.

C_{hf} and C_{equip} were estimated using the O'Hara method and corrected to 2007 terms using exchange rates and inflationary indices. C_{sink} was the variable element of cost estimated using the improved method.

The estimation methods for each of the terms in the above equations is set out within the following sub-sections.

D 3.2.1 Cost of equipping the shaft

The costs of the storage bins, skips, rope and man cages are estimated based on the production rate, T, in short tonnes (O'Hara et al, 1992):

$$C_{equip} = \$700\ T^{0.5}.$$

D 3.2.2 Cost of the shaft head frame

This cost is mainly determined by the mass of the steel required for the head frame. The total mass of steel used in the head frame depends on its height and the braking strength of the hoist rope. In turn, the height of the head frame depends on the skip size, which is one of the determinants of the production rate. The height of the head frame is set to allow the skips to dump their payloads into surface bins that scale with the production rate. Additional factors in establishing the height of the head gear are safety margins for over travel and braking distances that have to be catered for.

The empirical formula used to estimate the permanent head frame height consists of two parts. The first term relates to the production rate and the second term represents the breaking distance and skip over travel allowances (O'Hara *et al*, 1992). The height of the head frame is thus found from:

$$H = 8.0\ T^{0.3} + 1.2\ S^{0.5}$$

where H is the head frame height in feet, T is the daily production in short tonnes and S is the rope speed in feet per minute. The optimum rope speed in feet per minute, S, is derived from the depth of mining, D_s, (feet) and the daily production rate, T (short tonnes):

$$S = 1.6\ D_s^{0.5}\ T^{0.4}$$

The total mass of the steel is also depends on the hoist drum. The mass of the hoist winder depends on its diameter, which, in turn, is determined by the production rate and shaft depth. The hoist drum diameter, D, in feet is estimated using the empirical formula:

$$D = 4.13\ T^{0.3}\ D_s^{0.14}$$

Once the minimum height of the head frame and the hoist drum diameter are determined the mass in pounds of required structural steel, W, can be estimated from the formula:

$$W = 0.12\ H^3\ (D/100)^2$$

The capital cost of the head frame including the winder finally is estimated by using the empirical formula:

$$C_{hf} = \$19\ (1.2W)^{0.9}$$

D 3.2.3 Cost of grout

The amount of grout needed depends on the lithology of the overburden materials the shaft penetrates, in particular how porous the rocks are and whether or not they are fully or partially saturated with water. Rocks with a high porosity require larger volumes of grout to seal the rock satisfactorily. Table D 3.2 sets out the grout consumption rates adopted in the research. In very wet ground with high water pressures, the grout consumption is likely to be towards the higher end of the given range.

Table D 3.2: Grout Consumption

Lithology	Grout Rate, G_c, (tonnes/metre)		
	from	to	average
Sandstone	3.3	16.5	9.9
Dolomite	2.2	4.4	3.3
Chalk	4.0	4.0	4.0
Diabase	0.6	1.0	0.8

For cost estimation purposes an average grout price of £103.16 / tonne is used (Langdon, 2006) and thus the cost of grout is:

$$C_{grout} = 103.16\ D_s \times G_c$$

where D_s is the shaft depth and G_c is the grout rate in tonne/metre of shaft depth.

D 3.2.4 Costs of drilling

The cost of drilling required comprises:

$$C_{drill} = C_{gh} + C_{ph} + C_{bh}$$

where
- C_{gh} is the cost of drilling grout holes
- C_{ph} is the cost of drilling probe holes
- C_{bh} is the cost of drilling blast holes

The amount of drilling required for blasting purposes depends heavily on the drilling pattern that in turn depends on the rock type through which the shaft advances. In this formulation the number of holes required, N, for blasting is calculated using an empirical formula which considers the shaft area, A. (Unrug, 1992).

$$N = 2.55A + 22$$

The number of grout injection holes required is also assumed to depend on shaft cross sectional area and is assessed using example drill patterns in Chapter 17 of the SME Mining Engineering Handbook (O'Hara *et al.*, 1992).

Four probe holes designed to check for the presence of water ahead of the advancing shaft bottom are assumed to be drilled in opposing directions at the shaft bottom as indicated by Unrug (1992). Table D 3.3 sets out the length of drilling required for each type of hole and for each type of shaft required to match the underground mine models specified. Table D 3.4 details the number of each type of drill hole required.

Table D 3.3: Drillhole lengths

Tonnes/day	1,500	2,500	5,000	14,000	Vent
Tons/day	1,654	2,756	5,513	15,436	
Round advance (m)	1.5	1.5	1.5	1.5	1.5
Grouting Depth (m)	10	10	10	10	10
Probe Hole Length (m)	9	9	9	9	9

Table D 3.4: Number of Drillholes

Tonnes/day	1,500	2,500	5,000	14,000	Vent
Tons/day	1,654	2,756	5,513	15,436	10
Blastholes/round	83	94	107	135	72
Groutholes/round	18	20	26	30	18
Probe holes/round	4	4	4	4	4

If the unit cost of any drilling is £16/metre (Langdon, 2006), then the drilling costs are:

C_{bh} = Round advance x Blastholes/round x £16/metre
C_{gh} = Grouting depth x Groutholes/round x £16/metre
C_{ph} = Probe hole length x Probeholes/round x £16/metre

for any of the production rates or the ventilation shaft.

D 3.2.5 Cost of explosives

The consumption of explosives depends on the rock type in which the shaft is sunk. A consumption of 1.3 kg/m^3 is assumed for blasting in Sandstone and a consumption of 1.1 kg/m^3 is assumed for blasting in other rock types, due to the increased difficulty in obtaining satisfactory fragmentation in sandstones relative to other rock types. The total explosives cost is then calculated using:

$$C_{expl}. = 0.50(A \times D_s \times PF_{vol})$$

where A is the shaft cross sectional area in m^2, D_s is the shaft depth in meters and PF_{vol} is the volume based powder factor in kg explosive /m^3 rock broken.

D 3.2.6 Cost of labour

Labour is an important, and often the most significant, cost in the shaft sinking operation. An average advance rate of 15 metres per month for wet shafts and 23 metres per month for dry shafts is assumed. These rates, together with a figure for the depth of shaft, permit the total time taken to develop the shaft to be calculated. An average shaft sinking crew is assumed to comprise 25 operatives for any major hoisting or man-riding shaft, rising to 30 operatives for the highest capacity shaft. Due to reduced shaft equipping requirements, the crew is assumed be 20 strong for ventilation shafts. These manpower requirements together with the shaft development time allow the total man-hours to be established. Langdon (2006) provides an average labour rate for such activities as £20/man-hour. The total cost of labour is thus:

$$C_{labour} = 20 \times \text{total man-hours}$$

D 3.2.7 Cost of lining

Permanent shaft liners are assumed to be installed in cases of shafts sunk through water bearing strata, as the shafts have to be watertight. Unlike dry shaft sinking, installation of the liner is more critical to ongoing development and therefore takes place rapidly after each round. Water and ground pressures acting on the liner can be substantial so the liner has to be well engineered, and steel reinforced lining is most commonly used in wet conditions. Table D 3.5 summarises the input parameters for lining cost estimation for a 600 metre deep shaft and a concrete lining thickness of 0.50 m. The total lining volume and required reinforcement are calculated according to the shaft depth. The average cost for concrete is set to £87.75/m^3 and the cost for steel reinforcement is £3.13/m^2 (Langdon, 2006).

Table D 3.5: Shaft Lining Characteristics for a 600 metre deep shaft

Input Parameters	Tonnes/day	1,500	2,500	5,000	14,000	Vent
	Tons/day	1,654	2,756	5,513	15,436	
Lining thickness	m	0.50	0.50	0.50	0.50	0.40
Lining volume	m^3	2,474	2,710	2,945	3,416	1,810
Lining reinforcement	m^2	20,735	22,619	24,504	28,274	18,850

The total shaft lining costs then are estimated by adding the cost for concrete and the reinforcement:

$$C_{lining} = 87.7\,5 \times V_l + 3.13 \times A_r$$

Where V_l is the volume of the liner in m^3 and A_r is the shaft wall area in m^2.

D 3.2.8 Cost of surface facilities

The fixed cost of the shaft sinking operation mainly depend on whether wet or dry conditions are to be found in the shaft sunk and are 40% higher than shaft sinking in dry rock due to the necessity for increased pumping and the erection of a grout plant onsite (O'Hara, 1992). The fixed cost are therefore calculated using:

$$C_{facilities} = K \times \$135{,}000\ d^{0.5} \qquad \text{(O'Hara, 1992)}$$

where d is the shaft diameter in feet and K is a constant that is 1.4 for wet shafts and 1.0 for dry shafts.

D 3.2.9 Wet or dry shafts

For wet shafts the total capital cost of developing the shaft is thus:

$$C_{shaft} = C_{grout} + C_{bh} + C_{gh} + C_{ph} + C_{expl.} + C_{labour} + C_{lining} + C_{facilities} + C_{hf} + C_{equip}$$

and for dry shafts:

$$C_{shaft} = C_{bh} + C_{expl.} + C_{labour} + C_{lining} + C_{facilities} + C_{hf} + C_{equip}$$

From comparison between the two equations above it is clear that the differences in cost between wet shafts and dry shafts is a result of:

- significantly reduced grout consumption;
- significantly reduced drill holes; and
- increased man-power costs as a result of the sinking delays associated with wet sinking.

D 3.2.10 Basic O'Hara Formulation

Brief details of the basic O'Hara formulation are presented here in order that verification comparisons can be made with the enhanced model discussed above that was assimilated into valuation calculations.

In the O'Hara, 1992 formulation for the total capital cost of developing a shaft is:

$$C_{shaft} = C_{sink} + C_{hf} + C_{equip}$$

as before, but C_{sink} simply comprises:

$$C_{sink} = C_f + C_u$$

where C_f is a fixed cost and C_u is a unit cost £/m. These costs of shaft sinking operations are dependent on the cross sectional area of the shaft and the depth of the shaft. In the case of aggregates hoisting using skips, the shaft diameter can be estimated using the following empirical relation with daily production rate in short tonnes.

$$d = 5.5\ T^{0.15}$$

where d is the shaft diameter in feet and T is the daily production in short tonnes.

The total shaft sinking operations costs are divided into a fixed cost component and a unit cost per metre (or foot) of shaft sunk. Unit cost tends to increase with depth as hoisting trip times increase. Fixed costs and unit costs of shaft sinking are estimated with the use of empirically derived formulas in O'Hara's formulation (O'Hara *et al.*, 1992) as follows.

The fixed cost element for circular shaft sinking operations is given by:

$$C_f = \$135{,}000\ d^{0.5}$$

and the depth dependent element (per foot of shaft) is given by:

$$C_u = \$307\ d^{\,0.7}\ D_s^{\,1.05}$$

where d is the shaft diameter in feet and D_s is the shaft depth in feet. To convert feet to metres a conversion factor of 3.28084 feet per metre is used.

O'Hara's method is adopted to provide a check on the modified formulation which can accommodate wet and dry shaft models, and varying shaft geology. A set of sample calculations is presented in Table D 3.6 to Table *D 3.8*. These demonstrate excellent consistency between the formulations for a simplified dry shaft case.

Table D 3.6: Shaft sinking model input parameters for 776 metre deep shaft that is dry

Input Parameters	Tonnes/day	1,500	2,500	5,000	14,000	Vent
	Tons/day	1,654	2,756	5,513	15,436	
Shaft Diameter D	m	5.5	6.0	6.5	7.5	5.0
Area	m^2	23.8	28.3	33.2	44.2	19.6
Depth	m	776	776	776	776	776
Excavated volume	m^3	18,436	21,941	25,750	34,283	15,237
Shaft diameter	ft	18	20	21	25	16
Area	ft^2	255.7	304.3	357.2	475.5	211.3
Depth	ft	2,546	2,546	2,546	2,546	2,546
Excavated volume	ft^3	651,077	774,835	909,355	1,210,680	538,080
Installed winder power	Hp	253	448	974	3,085	3,085
Rope speed	m/s	3.3	4.1	5.4	8.2	3.0
Rope speed	f/min	658	807	1,065	1,608	591
Drum diameter	inch	90	104	129	175	67
Drum diameter	m	2	3	3	4	2
Headframe height	ft	105	120	145	193	29
Headframe height	m	32	37	44	59	9
Steel in headframe	lbs	132,615	272,990	728,974	3,152,162	1,603
Steel in headframe	Tonnes	60	124	331	1,430	1

Table D 3.7: Modified O'Hara 1992 formulation of shaft capital cost, for the shaft specified in Table D 3.6 and dry development.

CAPEX		Shaft Capacity (tonnes per day, or ventilation shaft) 1,500	2,500	5,000	14,000	Vent
Sinking CAPEX						
Fixed	2006 £	923,431	964,492	1,003,876	1,078,335	880,457
Sinking	2006 £	9,495,808	9,674,747	10,514,048	11,906,469	7,661,294
Total Sinking	2006 £	10,419,239	10,639,239	11,517,924	12,984,804	8,541,751
Headframe CAPEX						
Structure	1992 $	912,748	1,748,028	4,231,143	15,803,905	17,158
Skips, etc	1992 $	125,325	179,197	291,107	598,498	0
Total Headframe	1992 $	1,038,073	1,927,225	4,522,250	16,402,403	17,158
Hoisting Plant CAPEX						
Hoist	1992 $	1,145,235	1,591,348	2,486,729	4,826,121	1,257,314
Hoist Installation	1992 $	209,098	275,517	400,594	698,506	123,912
Total Hoist Plant	1992 $	1,354,333	1,866,865	2,887,323	5,524,627	1,381,226
CAPEX excl. Sinking	**1992 $**	**2,392,406**	**3,794,090**	**7,409,573**	**21,927,030**	**1,398,384**
CAPEX excl. Sinking	1992 £	1,364,174	2,163,428	4,225,013	12,503,012	797,373
CAPEX excl. Sinking	2006 £	2,751,717	4,363,918	8,522,403	25,220,208	1,608,405
Sinking CAPEX 2007	2006 £	10,419,239	10,639,239	11,517,924	12,984,804	8,541,751
Total CAPEX 2007	**2007 £M**	**13.17**	**15.00**	**20.04**	**38.21**	**10.15**

Notes: Average $:£ exchange rate in 1992 = 0.57 $/£. UK Inflationary index 1992 to 2007 assumed = 2.02. Shaded areas highlight 2006 figures.

Table D 3.8: Basic O'Hara 1992 formulation of shaft capital cost, for the shaft specified in Table D 3.6 and dry development.

CAPEX		Shaft Capacity (tonnes per day, or ventilation shaft) 1,500	2,500	5,000	14,000	Vent
Sinking CAPEX						
Fixed	1992 $	573,466	598,966	623,423	669,664	546,778
Sinking	1992 $	8,764,374	9,314,786	9,851,591	10,889,549	8,198,719
Total Sinking	1992 $	9,337,840	9,913,752	10,475,014	11,559,213	8,745,498
Headframe CAPEX						
Structure	1992 $	912,748	1,748,028	4,231,143	15,803,905	17,158
Skips, etc	1992 $	125,325	179,197	291,107	598,498	0
Total Headframe	1992 $	1,038,073	1,927,225	4,522,250	16,402,403	17,158
Hoisting Plant CAPEX						
Hoist	1992 $	1,145,235	1,591,348	2,486,729	4,826,121	1,257,314
Hoist Installation	1992 $	209,098	275,517	400,594	698,506	123,912
Total Hoist Plant	1992 $	1,354,333	1,866,865	2,887,323	5,524,627	1,381,226
Total CAPEX 1992	1992 $	**11,730,246**	**13,707,842**	**17,884,587**	**33,486,243**	**10,143,882**
Total CAPEX 1992	1992 £	6,688,704	7,816,349	10,197,971	19,094,191	5,784,143
Total CAPEX 2007	**2007 £M**	**13.49**	**15.77**	**20.57**	**38.52**	**11.67**

Notes: Average $:£ exchange rate in 1992 = 0.57 $/£. UK Inflationary index 1992 to 2007 = 1884/934 = 2.02.

D 3.3 Operating costs

The operational costs for the underground models are calculated using the same approach as for the quarry models. The applied mining method determines the total number and type of equipment used. The costs for fuel and spares are derived from the equipment set up. Power consumption is increased compared to equivalent surface operations due to the extra costs for mine ventilation which are significant. Blasting costs are calculated for each method separately and fed into the model. The assumptions made in the blast design are discussed below.

D 3.3.1 Fuel

Underground aggregate mines are hard rock mines where there are typically reduced problems related to methane gas occurrences in comparison to coal mines. Diesel equipment is commonly used underground in hard rock mines, and this is assumed to be the case exclusively in the underground aggregates mining operations considered here. Fuel consumption depends on the number and size of the mobile plant selected and utilised. Fuel consumption is calculated based on the engine rating and utilisation factors of utilization factor of 83% for heavy plant and 40% for light vehicles that are less intensively used (Kumar, 2007). In the long hole open stoping method a sublevel has to be developed before production stoping can take place. Working on two levels increases equipment requirements generally as more faces have to be worked simultaneously.

D 3.3.2 Power

Typically a few mine services have the highest share in the total power consumption. Working underground requires ventilation. The primary fan is the backbone in maintaining healthy work conditions underground. To overcome air frictional resistance and shock losses over the complete underground ventilation circuit requires high installed power ratings for the primary fan motors and very high load factors. In the case of mine ventilation, probably the biggest issue in terms of cost is the 24-7 duty of the fans.

Pumping demand contributes to the power consumption, as the power draw is directly related to the head and hence depth of workings. Primary crushing and hoisting of crushed material are the two remaining large contributors to power consumption. In the mining models the power consumption is calculated from the installed power rating specification. The rating is multiplied by the total operating hours for each individual piece of equipment. Full power consumption will only occur on start-up, a load factor of 60% has therefore been assumed. For the shaft access models the installed power from the winder is estimated based on an empirical derived formula:

$$H_p = 0.5\ (D/100)^{2.4}\ S$$

In which H_p is the installed horse power, D is the hoist drum diameter in feet and S the rope speed in feet per minute

$$S = 1.6\ D_s^{0.5}\ T^{0.4}$$

$$D = 4.13\ T^{0.3}\ D_s^{0.14}$$

where D_s is the shaft depth in feet and T is the daily production rate in short tons (O'Hara, 1992). The total power consumption for each mining model is the sum of the installed power multiplied by the load factor multiplied by the operating hours. The electricity consumption costs then multiply this total by the price per kWh for electricity.

D 3.3.3 Room & Pillar Blasting

The dimensions of the rooms to be driven are a trade-off between the width to height ratio of the pillars to be left, the rock properties, the stratification of the deposit, geological features such as faulting and the size of the worked equipment for the production phase and potentially, for the after use phase. Face dimensions are assumed to be the same for all scenarios, except for the 1,500 tpd scenario. Variation in production is achieved by working more faces at a time and an increased face advance rate. Production face dimensions are 12 to 14 metres wide x 8 metres high with an advance rate of 3 to 6 metres per round. Face drilling is performed using a two boomed drilling jumbo. The number of drilled holes depends on the length of the holes and is calculated using a drill factor of 1.5 m^3 of broken rock per drilled metre. In each blast design 5 drill holes are added to create the round free surface in the box-cut. A powder factor of 0.2 kg per tonne is applied to calculate the total amount of explosives per face. Each hole is initiated with use of one NONEL detonator and one primer.

D 3.3.4 Long hole blasting

Long hole open stoping involves the development of two levels in order to blast open stopes in-between. The upper level is called the sublevel and is formed by a set of drives with limited cross sectional area. Long hole drilling is performed from this level down to the main level below, where broken rock is loaded and hauled to the primary crusher. The stone between the two levels is blasted in planned areas to form large open stopes. The as in the room-and-pillar model, the dimensions of the stopes are a trade-off between the width to height ratio of the pillars to be left, the rock properties, the stratification of the deposit, geological features such as faulting and the potential after use. These considerations resulted in a stope design as in Figure D 3-1. Typical dimensions of the stopes are w x h x l, 14 x 20 x 50 metres. These dimensions may vary in each model to meet the production requirements, subject to stability with a factor of safety of 1.8. The stopes are mined by means of ring blasting. For specification and costing purposes, a ring design has been established for each production scenario, identifying the number of holes per ring, blast hole burden and spacing. These parameters, combined with the daily required retreat determine the amount of explosives, primers and detonators used daily.

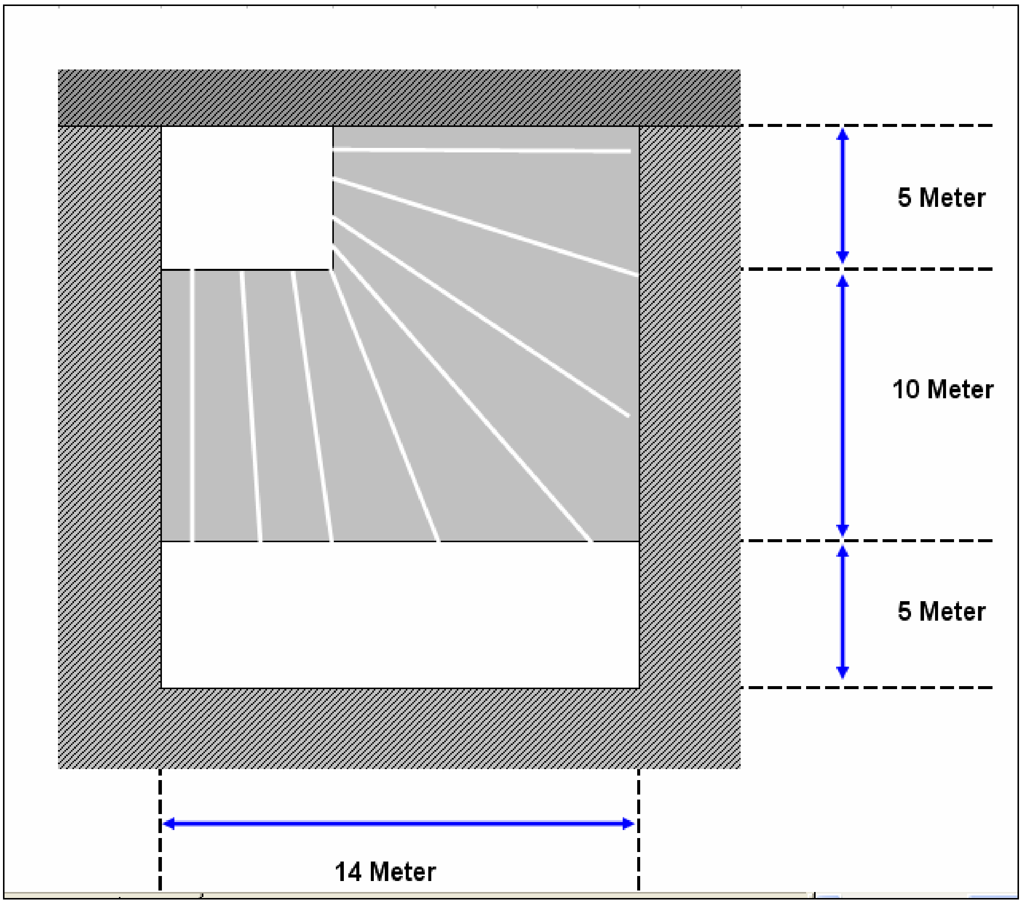


Figure D 3-1: Schematic cross section through a long hole stoping stope showing ring drilling pattern.

Development of both sublevel and haulage level have to keep pace with the rate of retreat in the stoping operation. The amount of development equipment is therefore dependant on the stoping operation. Blasting specifications for development openings are roughly the same as those for the room-and-pillar model. Variation in production is achieved by working more stopes at a time and an increased number of blasted rings per blast. Ring drilling is done with a long hole drill rig and face drilling is performed using a two boomed drilling jumbo. In development blasting the number of drilled holes depends on the length of the holes and is calculated using a drill factor of 1.5 m^3 of broken rock per drilled metre. In each blast design 5 drill holes are added to create the round free surface in the box-cut. A powder factor of 0.2 kg per tonne is applied to calculate the total amount of explosives per face. Each hole is initiated with use of one NONEL detonator and one primer.

D 3.3.5 Summary of Underground Mining Operating Costs

Table D 3.9 summarizes the operational costs per tonne for each considered model and production scenario. A full breakdown of these costs is provided in Appendix E for room-and-pillar and Appendix F for long hole stoping.

Table D 3.9: Underground mining operating costs

<table>
<tr><th colspan="7">Underground Unit Operational Cost</th></tr>
<tr><th colspan="3">Daily Production</th><th>1,500</th><th>2,500</th><th>5,000</th><th>14,000</th></tr>
<tr><td rowspan="4">R&P</td><td rowspan="2">Shaft</td><td>wet</td><td>£6.40</td><td>£5.69</td><td>£4.46</td><td>£2.45</td></tr>
<tr><td>dry</td><td>£6.30</td><td>£5.60</td><td>£4.38</td><td>£2.40</td></tr>
<tr><td rowspan="2">Decline</td><td>wet</td><td>£7.36</td><td>£6.29</td><td>£4.64</td><td>£2.30</td></tr>
<tr><td>dry</td><td>£7.25</td><td>£6.21</td><td>£4.56</td><td>£2.26</td></tr>
<tr><td rowspan="4">LH</td><td rowspan="2">Shaft</td><td>wet</td><td>£12.26</td><td>£11.48</td><td>£8.71</td><td>£4.03</td></tr>
<tr><td>dry</td><td>£12.13</td><td>£11.39</td><td>£8.63</td><td>£3.98</td></tr>
<tr><td rowspan="2">Decline</td><td>wet</td><td>£10.84</td><td>£10.83</td><td>£7.89</td><td>£3.60</td></tr>
<tr><td>dry</td><td>£10.74</td><td>£10.75</td><td>£7.81</td><td>£3.56</td></tr>
</table>

D 4 Quarry cost models

The aggregate quarry model considers the actual winning of stone and primary crushing. Therefore only costs for pre-stripping, drilling, blasting, loading, hauling to the primary crusher and primary crushing are included. The remaining costs associated with processing the rock into saleable products are included with in the processing cost model (Section D 5). Three different stripping scenarios were considered: no stripping, 1.5 metres and 3 metres depth.

D 4.1 Capital costs

The fleet of mobile plant in any of the considered quarry models makes up 80 to 90% of the capital requirement. Differences in capital costs are the result of the total number and size of employed plant. Any stripping of overburden material is assumed to be executed with owned equipment. In practice however this is frequently contracted out to a third party. Greater stripping depths are dealt with in the quarry models by scaling the equipment to suitable sizes. It should be mentioned that most active quarries operate sites that have either been stripped in the past or have hardly any overburden, but the models with 1.5 and 3.0m pre-strip are included for completeness.

D 4.1.1 Site Development

The volume of stripped material is calculated assuming three overburden thickness scenarios. The material is stripped prior to stone extraction by use of dedicated equipment as mentioned in the equipment set up section of the Operation Characteristics sheet of the quarry model. The soil material is stripped using a bulldozer, after which a hydraulic excavator (backhoe) is used to load the material into articulated trucks. The backhoe is also used for overburden removal in cases where an irregular rock-surface requires improved control on clearing of the overburden. For most operations the size and number of overburden removal equipment is the same. This is because increased production (i.e. 2,500 tonnes per day compared with 5,000 tonnes per day) is assumed to be achieved by working multiple benches in the quarry at the same time; doubling the production rate does not necessarily double the quarry pit's land footprint. Only the top end production scenario is assumed to be in need of larger equipment due to the high advance rate of the benches and the increased hauling distances.

The tonnage of removed material is calculated by multiplying the total volume with an average overburden density of 2 tonne/m^3. The entry to the quarry is assumed to be level with the processing plant at the start of production, for this reason no haul road construction is necessary. The primary crusher is assumed to be located at a central point outside the pit, resulting in a constant average hauling distance of half the pit size. The maximum spatial extent of a small quarry is assumed to be 500 metres diameter. Quarries with greater production rates will require larger pits that may have spatial extents of 1,000 to 1,600 meters diameter. Site clearing for the erection of processing plant and other buildings is included in the building costs specifications.

D 4.1.2 Equipment

Broadly, the equipment set up for each production scenario was derived from a survey of operating practice of more than 40 UK quarries, evidenced in the archived reports of quarry operations held within the Camborne School of Mines library. Face loading is typically done with use of a wheel loader serving two trucks. Increased daily production is achieved by working the loader more efficiently so that more trucks can be served, even with a longer haul distance. Scaling of the equipment upwards enhanced subsequent production capacity, but the numbers of units are broadly the same. For very high production rates a hydraulic face shovel is used to handle large blasts. The number of worked benches determines the number of drill rigs and the load – haul systems. Each operation is assumed to have a water tanker and a service truck available for daily maintenance and dust suppression. In the scenarios where blasting is done in-house a powder buggy is assumed owned by the operator. Pumping is only considered in those scenarios where multiple benches are in production, reaching lower pit floor levels in order to maximize tonnage within surface restrictions. Although the need for pumps is largely dependent on the depth of the aquifer and the geographical location of the site, the survey of operating practice identified the use of two pumps as the typical pumping equipment requirements for larger scale operations. Personnel transport on site assumes 4x4 (pick-up) trucks. The number of vehicles in use is proportional to the number of faces in use (including stripping) and the number of staff. Furthermore has it been assumed that all equipment is owned and operated by the quarry operator. The equipment is worked up to the end of its expected useful life after which it is replaced. Expected equipment lifetimes are retrieved from the database, and used to schedule replacement capital expenditure.

D 4.1.3 Buildings

All building requirements are taken from Western Mine's Mine and Mill Equipment Costs, An estimators guide (Western Mine, 2006a)

D 4.1.4 Summary of Quarry capital costs

Table D 4.1: Quarry total capital costs. (£)

Quarry Capital Cost				
Strip \ tpd	1,500	2,500	5,000	14,000
0.0	6,107,036	9,295,371	20,127,457	22,635,338
1.5	8,451,662	13,291,324	23,599,126	26,154,872
3.0	8,952,479	14,295,276	24,001,988	26,605,598

D 4.2 Operating Costs

The assessment of the operational costs in the quarry model considered the costs of operating the equipment, labour and the costs of consumables. Described below are the model specific assumptions that have been made for the quarry scenarios. The operational costs for all considered quarry models are summarized in Table D 4.2.

D 4.2.1 Blasting

The bench height in all production scenarios was limited to 15 metres. Total blast sizes should be such that they cater for at least one day of production. The survey of UK quarry operating practice showed that Quarry blast sizes are typically between 10,000 to 20,000 tonnes, and confirmed that the resulting powder factors, averaging 0.15 kg/tonne, are close to the theoretical optimum for limestone blasting. Typical blasthole diameters considered ranged between 115 mm and 127 mm for the lowest and highest production rates respectively. The average charge per hole is 100 kg ANFO, with two decks, each initiated with a primer and a NONEL detonator. The number of holes per blast is calculated from the total blast mass for each production scenario in conjunction with the powder factor. Three feet (~1metre) of sub-drilling is assumed in calculating the drilling factor. If blasting is not to be done on a regular basis (less than once a week), all the blasting (hole preparation, charging and blasting) is assumed to be contracted out to a explosives contractor.

D 4.2.2 Consumables

The fuel consumption is calculated by breaking down the fuel requirements given in the Western Mine's Mine and Mill Equipment Costs, an estimators guide (Western Mine, 2006a) to litres per operating hour. These were multiplied by the operating hours per day and the utilization rate to determine the total daily fuel consumption. The electricity consumption in the pit is determined by the total installed power of electrical powered equipment, which mainly comprises the primary crusher motors. Explosives, primer and detonator consumption is expressed in daily required amounts, even if blasting actually occurs only once a week. The total quantity of explosives, primers and detonators are calculated assuming two decks per hole and the given powder factor. The total length of required detonation cord is taken from the Western Mine's Costs Service (Western Mine, 2006b). Drill-bit wear is assumed to be moderate.

D 4.2.3 Summary of Quarry operating costs

Table D 4.2: Quarry Operating Costs

Quarry Unit Operating Cost				
Strip \ tpd	1,500	2,500	5,000	14,000
0.0	£2.06	£2.21	£2.22	£1.00
1.5	£2.60	£2.79	£2.44	£1.11
3.0	£2.69	£2.95	£2.55	£1.13

D 5 Processing cost model

D 5.1 General

As soon as the mined stone is past the primary crusher and hoisted to the surface, or hauled from surface quarry pits it flows into the processing plant which is designed to reduce its size to a range of marketable products ready for load out and transport to market. Processing plant models have been developed that match all the production rate scenarios considered in the underground mining or quarrying models. One of the prime assumptions in equipment selection and processing plant design is that the input material to be competent stone.

Aggregate production from broken rock involves crushing and screening, but the extent of treatment the material has to undergo is dependent on the required specifications of the final products. The survey of UK quarrying practice undertaken in the initial part of the research did not identify a clear trend in the number and type of final products. Rather, it appeared that the operations reviewed served client specific specifications. Thus in order to keep the processing plant model specifications modular and comparable a standard product mix was used for each the individual processing scenarios and these are detailed in the processing plant specification pages.

Process flow sheets were designed with the use of Metso Mineral’s Bruno software and this enabled a detailed specification of each plant to be considered. Separate flow sheets were designed for the processing of more competent aggregate rock, such as granite (and hence is referred to as ‘the granite model’), and less competent materials, such as some limestones (and hence is referred to as ‘the limestone model’). The flow sheets are presented in Appendix G.

Equipment selection for the two different rock type processing scenarios was informed by consultation with Metso process design experts (Morrow, 2009). Screen sizing and bed thickness calculations resulted in selection of appropriate screens (Mullar et al, 2002). The cost models developed from the process flow sheets include capital costs for equipment and buildings, labour costs and fuel and electricity costs. The models are specific to the UK with costs expressed in terms of Sterling for 2007.

The processing plants are assumed to be erected on the mine site coinciding with the development of the mine or quarry with some shared facilities with the stone producing units but are specified and costed as stand-alone operations.

D 5.2 Capital costs

Crushers, feeders and screens are located in large, shed like buildings. Most final products are stored outdoors without any cover. The finer material is stored in covered storage facilities, which are scaled to the size of the operation. Wheel loaders are used to load trucks and move material around the site. Belt conveyors are assumed to be the major material handling system, transporting aggregate between the separate processing steps. Stockpiling in surge bins is assumed for each new step in the processing of the aggregate. An office block is assumed to be alongside weighbridge facilities close to the load out point.

The capital cost of the processing plant can be divided into costs for the crushing circuit, the screening circuit, buildings and mobile plant. Of these, the expenditures on crushing and screening plant are by far the greatest. Primary crushers are not included in the processing plant models as they are included in the surface quarrying and underground mining production cost models. Thus the costs in the ‘Primary’ heading of Table D 5.1 and Table D 5.2 are the costs for scalping screens. In the granite model the secondary crusher is larger and needs replacement earlier due to the hard and abrasive character of the processed material, but the capital costs for buildings, site development and mobile plant are comparable to the limestone model.

D 5.2.1 Summary of processing plant capital costs

Table D 5.1: Limestone Processing Capital Cost

CAPEX	Total Cost			
Processing Limestone	GB£	GB£	GB£	GB£
Daily Production:	1,500	2,500	5,000	14,000
Primary	201,198	210,701	263,377	336,022
Secondary	3,287,434	3.295,882	5,750,379	12,706,679
Tertiary	6,416,970	6.416,970	11,015,168	11,402,215
Screening	5,655,092	5.673,042	7,096,019	8,094,457
Buildings	1,937,405	2.366,256	2,947,556	4,930,556
Development	282,911	310,894	520,529	643,250
Mobile Plant	3,646,969	3.718,241	8,810,557	12,621,901
Total Capital:	21,427,979	21,991,986	36,403,585	50,735,080

Table D 5.2: Granite Processing Capital Cost

CAPEX	Total Cost			
Processing Granite	GB£	GB£	GB£	GB£
Daily Production:	1,500	2,500	5,000	14,000
Primary	201,198	210,701	263,377	336,022
Secondary	6,355,091	6,363,538	9,686,017	23,541,027
Tertiary	6,416,970	6,416,970	11,015,168	11,402,215
Screening	5,655,092	5,673,042	7,096,019	8,094,457
Buildings	1,937,405	2,366,256	2,947,556	4,930,556
Development	282,911	310,894	520,529	643,250
Mobile Plant	3,646,969	3,718,241	8,810,557	12,621,901
Total Capital:	24,495,636	25,059,642	40,339,223	61,569,428

D 5.3 Operating Costs

The operating costs of a processing plant comprise costs of spares and wear parts, maintenance, labour and the costs for consumables, such as electricity and diesel. The main wear parts consumed during processing are screen mats and crusher liners. Typical lifetimes of these wear parts are appreciably different for the two rock types considered. Whereas crusher liners in the limestone model can last for 10,000,000 tonnes, they are not unlikely to be worn out after 100,000 tonnes in the igneous rock model (Barkwill, 2009). Igneous rocks are in general more abrasive than limestone, resulting in faster wear of fixed plant. Table D 5.3 summarizes the operational costs for the limestone processing model. Table D 5.3 also specifies fuel consumption of all mobile plant and the electricity power consumption.

D 5.3.1 Consumables

The fuel consumption is calculated by breaking down the fuel requirements given in the Western Mine's Mine and Mill Equipment Costs,an estimators guide to litres per operating hour. By multiplied this with the operating hours per day and the utilization rate, the total daily fuel consumption can be calculated. The electricity consumption in the processing plant is determined by the total installed power of electrical powered equipment, assumed load factors and operating hours (reported in the model specification pages). Replacement costs of screen and crusher liners are covered in the hourly operating costs (Western Mine, 2006a). The main assumption in this is that the costs of screen and crusher wear parts are not significantly higher in the UK than they are in the US.

D 5.3.2 Personnel

In the specification sections of the processing models, personnel paid on hourly rates and salaried personnel are considered in different sections. The number of equipment operators is dependent on the amount of equipment. The number of mechanics is calculated by using benchmark figures for maintenance and overhaul requirements per operating hour to FTE mechanic hours per working year. The number of general labourers is determined by the need for “extra” hands on the job and for general maintenance and site cleaning duties. In the model only processing, direct surface duties and direct management are included. The operational management is assumed to consist of the mine manager (all models) supplemented with one or two foremen for models with production rates above 1 million tonnes per annum. All office duties, marketing and processing personnel are not contained in this model. The processing plant specification pages provide detailed breakdowns of the staffing complements.

D 5.3.3 Summary of processing plant operating costs

Table D 5.3: Limestone Processing Operating Cost (Units are £, unless specified)

OPEX	Total Cost			
Processing Limestone	GB£	GB£	GB£	GB£
Daily Production:	1,500	2,500	5,000	14,000
Fixed Plant	122,379	122,537	179,610	314,529
Buildings	40,148	49,700	64,106	99,766
Equipment	38,055	39,007	67,629	121,504
Diesel Fuel	28,683	30,477	50,496	72,310
Diesel (litres / day)	151	160	266	381
Electricity	268,371	268,371	405,262	538,313
(kWh / day consumed)	13,763	13,763	20,783	27,606
Tyres	6,799	6,821	15,962	23,426
Personal Hourly Rate	160,441	205,101	304,931	592,188
Personel Fixed Wages	159,000	211,000	286,000	356,000
Total OPEX:	823,877	933,014	1,373,997	2,118,036
Annual Production (tonnes)	375,000	625,000	1,250,000	3,500,000
Unit OPEX (£/tonne)	2.20	1.49	1.10	0.61

In Table D 5.4 the operational costs for the granite processing model are given. The increased wear of fixed plant is evident in increased operational costs compared with the limestone model. It has been assumed that site logistics are no different compared to the equivalent limestone operation. Therefore mobile plant operational costs are the same. The selection of crushers that can deal with the granite rock characteristics resulted in the slightly lower power consumption for processing plants with lower production rates. This due to the specific type of equipment selected. Decreased liner lifetimes will increase the required maintenance, resulting in higher maintenance labour costs.

Table D 5.4: Granite Processing Operational Cost (Units are £, unless specified)

OPEX	Total Cost			
Processing Granite	GB£	GB£	GB£	GB£
Daily Production:	1,500	2,500	5,000	14,000
Fixed Plant	383,177	383,491	567,874	1,002,475
Buildings	40,148	49,700	64,106	99,766
Equipment	38,055	39,007	67,629	121,504
Diesel Fuel	28,683	30,477	50,496	72,310
Diesel (litre / day)	151	160	266	381
Electricity	240,452	240,452	387,812	904,750
(kWh / day consumed)	12,331	12,331	19,888	46,397
Tyres	6,799	6,821	15,962	23,426
Personal Hourly Rate	253,758	298,418	399,158	814,559
Personel Fixed Wages	159,000	211,000	286,000	356,000
Total OPEX:	1,150,072	1,259,366	1,839,038	3,394,790
Annual Production (tonnes)	375,000	625,000	1,250,000	3,500,000
Unit OPEX (£/tonne)	3.07	2.01	1.47	0.97

D 6 Guide to cost model sheets in Appendices E to H.

In this section, an outline guide to the quarry, mine and processing plant specification and cost models presented in appendices E to F is provided. The structure of the cost models is the same for every considered scenario but interpreting the tables as presented in the appendices requires some explanation of their structure.

All the models start with the operation specification that takes the form of a set of tables detailing the assumed operational characteristics.

Following these, tables detailing the expected capital costs and equipment lifetimes are presented. Then tables detailing the operational costs are presented. Finally the time schedule of capital expenditure is reported. An explanation of each set of tables is given below.

D 6.1 Specification of the operation

The first three pages of appendices E, G and H and the first four of appendix F list the operation characteristics that feed into the cost modelling spreadsheets.

The input parameters start with the definition of the size of the operation and the blast parameters. The next page specifies the number and type of selected equipment. Unique cost codes link these specification to information on capital and operational cost in the standard costing system.

Following the equipment, specification of the surface facilities is presented. The specifications of operational characteristics conclude with a summary of the consumables and a staffing table.

All these input parameters feed into the capital and operational costs calculations that are presented in the pages following. In Figure D 6-1, an example of an operation characteristics input table is given.

Mining method

Access type

Production rate

Input parameters

Number of equipment items

Cost code

Room & Pillar		Daily Production							
Daily Production:		1.500	1.500	2.500	2.500	5.000	5.000	14.000	14.000
		Adit	Shaft	Adit	Shaft	Adit	Shaft	Adit	Shaft
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	[illegible]	[illegible]	[illegible]
Workingdays / year:	days	250	250	250	250	250	[illegible]	[illegible]	[illegible]
Life Of Mine (LOM):	years	20	20	20	20	20	[illegible]	[illegible]	[illegible]
Hourly Production:	tonnes	94	94	[illegible]	[illegible]	250	250	700	700
Yearly Production:	mton	0,4	0,4	[illegible]	[illegible]	1,3	1,3	3,5	3,5
width	meter	12,0	12,0	14,0	14,0	14,0	14,0	14,0	14,0
height	meter	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
cross-sectional area	m2	96,0	96,0	112,0	112,0	112,0	112,0	112,0	112,0
Rock density	tonne/m3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Daily Advance	meter	6	6	8	8	17	17	47	47
Depth of pull	meter	3	3	3	3	4	4	6	6
No. Faces	No.	2	2	3	3	4	4	8	8
Blast size	tonnes	763	763	890	[illegible]	[illegible]	1.187	1.781	1.781
Pulls per day	No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	8	8
Total Resource:									
Blast size:	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Powder factor:	kg/tonne	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Drill factor:	m/tonne								
Number of holes	No.	64	64,00	75	75	56	56	75	75
Reamer holes	No.	5	5	5	5	5	5	5	5
Total Number of holes	No.	69	69	80	80	61	61	80	80
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Primary Openings	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0043	UA0038	UA0043	UA0039	UA0043	UA0040	UA0043	UA0041
Ventilation Shafts	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0
Equipment									
Hydraulic Shovels	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	[illegible]	EU0129	EU0130	EU0130	EU0130	EU0130	EU0131	EU0131
Rear-dump Trucks	no	2	2	2	2	2	2	6	6
	type	E0249	[illegible]	E0258	EU0400	E0259	EU0402	E0260	EU0402
Drilling Jumbo's	no	1	1	1	1	2	2	3	3
	type	EU0093	[illegible]	[illegible]	[illegible]	EU0094	EU0094	EU0094	EU0094
Drills	no	1	[illegible]	[illegible]	[illegible]	2	2	3	3
	type	EU0081	[illegible]	[illegible]	[illegible]	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	[illegible]	[illegible]	[illegible]	2	2	2	2
	type	EU0083	[illegible]	[illegible]	[illegible]	EU0083	EU0083	EU0083	EU0083
Bulldozers	no								
	type								
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	1	1
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	1	1
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	4	4	4	4	6	6	8	8
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	3	3	3	4	4
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	no	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	no	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	no	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	no	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	no	1	1	1	1	1	1	1	1
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	no	31	23	42	35	50	43	75	66
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	no	1	1	1	1	1	1	2	2
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	no	31	23	42	35	50	43	75	66
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Figure D 6-1 Example of operating characteristics for room & pillar models

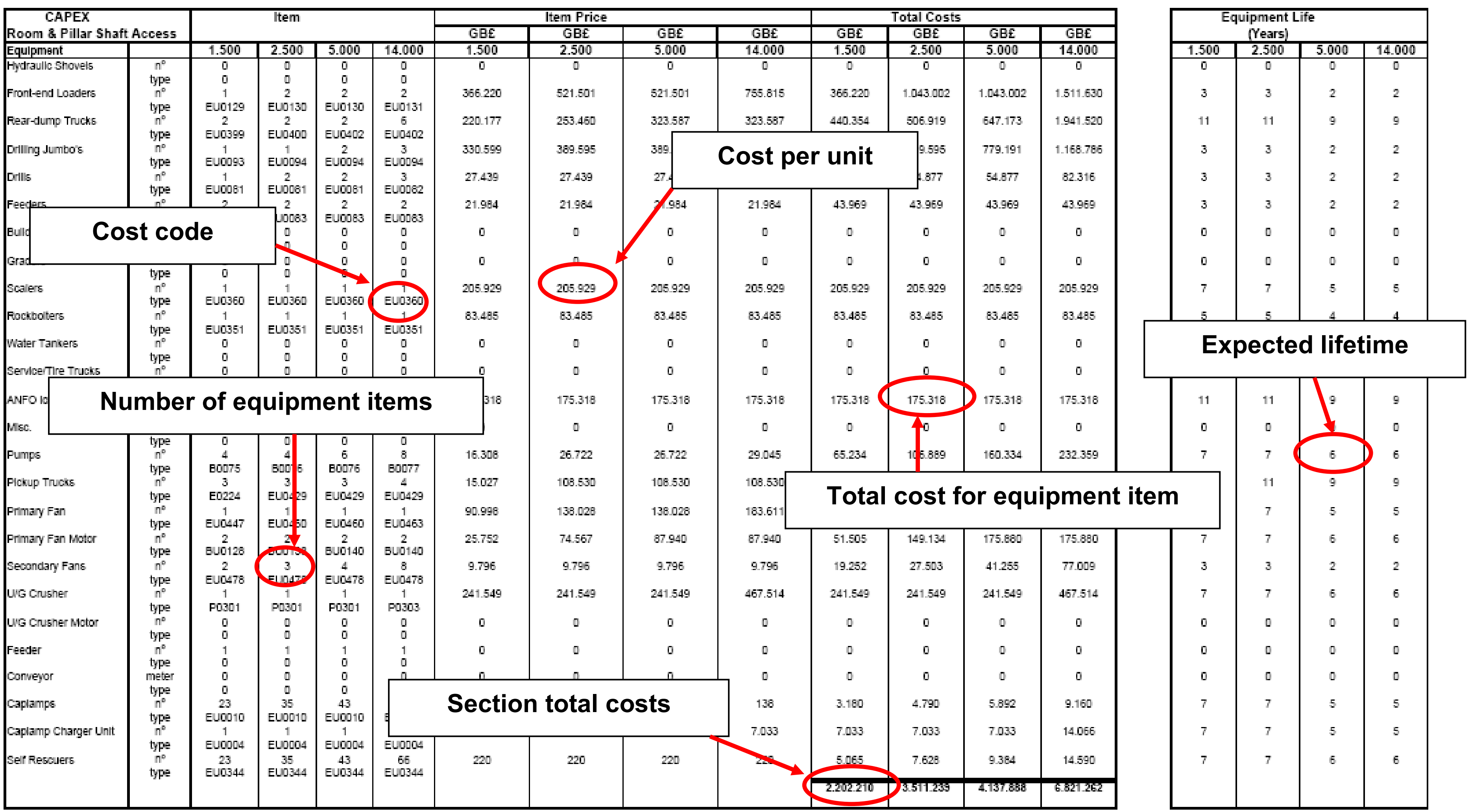


Figure D 6-2 Example of capital costs for room & pillar models

D 6.2 Capital cost statements

The capital costs calculation is divided in two pages with the first page describing equipment capital costs and the second page describing costs related to site facilities and development costs.

On the left hand side, the data from the operation specification input sheet is repeated to ease cross referencing. In the Item Price columns the cost for a single item is given. This price is multiplied by the number of required items resulting in a total capital cost in the right hand side of the table. To the right of the capital cost table the expected lifetime of each piece of equipment is shown. This lifetime depends on the operating hours of the considered operation. At the bottom of the last capital cost table the total initial capital costs for each scenario is given. In Figure D 6-2 an example of a room & pillar capital cost table is illustrated.

D 6.3 Operating cost statements

On the left hand side, the data from the operation specification input sheet is repeated to ease cross-referencing. The hourly costs of spares are listed in the item price columns. Tyre costs are separately considered in the columns right of the item price columns. The required maintenance in hours per year is calculated in the labour and fuel columns. The black number indicates the required annual maintenance and the fuel consumption in litres per day is indicated below in blue. The power consumption of electrically-driven equipment is displayed in red and is given in kWh per day. These numbers for fuel or power consumption are summarized in the consumables section and the total required maintenance hours are fed back into the staffing section, defining the number of mechanics that have to be employed. In the left hand side of the table the total annual operating cost excluding fuel, labour, tyre and overhead costs is given.

The first operational cost table concerns the cost for the equipment. On the second page the maintenance costs for buildings, consumables and labour costs are presented. The item costs for maintenance on buildings and the salaried personnel are given in pounds per year. The item costs for consumables are given in values per unit as stated in the second column from the left. The labour rates for hourly paid labour are given in gross hourly costs. The total amount of yearly required maintenance is displayed in the corresponding column on the mechanics row. The blue number in the consumables section represents the daily fuel consumption of the operation in litres and the red numbers state the daily power consumption in kWh. In Figure D 6-3 an example of a set of operational cost tables is given.

D 6.4 Equipment replacement capital expenditure

The last pages of each appendix contain a schedule of capital expenditure for a project life of 20 years for each production scenario. The schedule displays the cost of equipment replacement defined by type and year. The right hand table summarizes the total capital costs over the complete project life. In Figure D 6-4 an example of a schedule of capital expenditure table is presented.

D 6.5 Dry and wet models

For all the underground models two scenarios have been considered; a dry and a wet scenario. The key difference between the two scenarios is the capital cost of shaft sinking and increased operational cost due to pumping. Appendix E and F are divided in four parts with the first part considering the models with shaft access in wet conditions. The second part comprises the models for adit access in wet conditions. In part three and four the same models are given for dry conditions.

D 6.6 Processing models

Processing models matching the four considered production rates have been constructed for two rock types: limestone and granite. The processing flow sheets that form the backbone of the processing plant design and costing are incorporated into the Appendix G. The appendix has therefore been divided in four part. The first part deals with the limestone processing models, the second part with the granite processing models, the third part presents the limestone processing flow sheets and the last part presents the granite processing flow sheets.

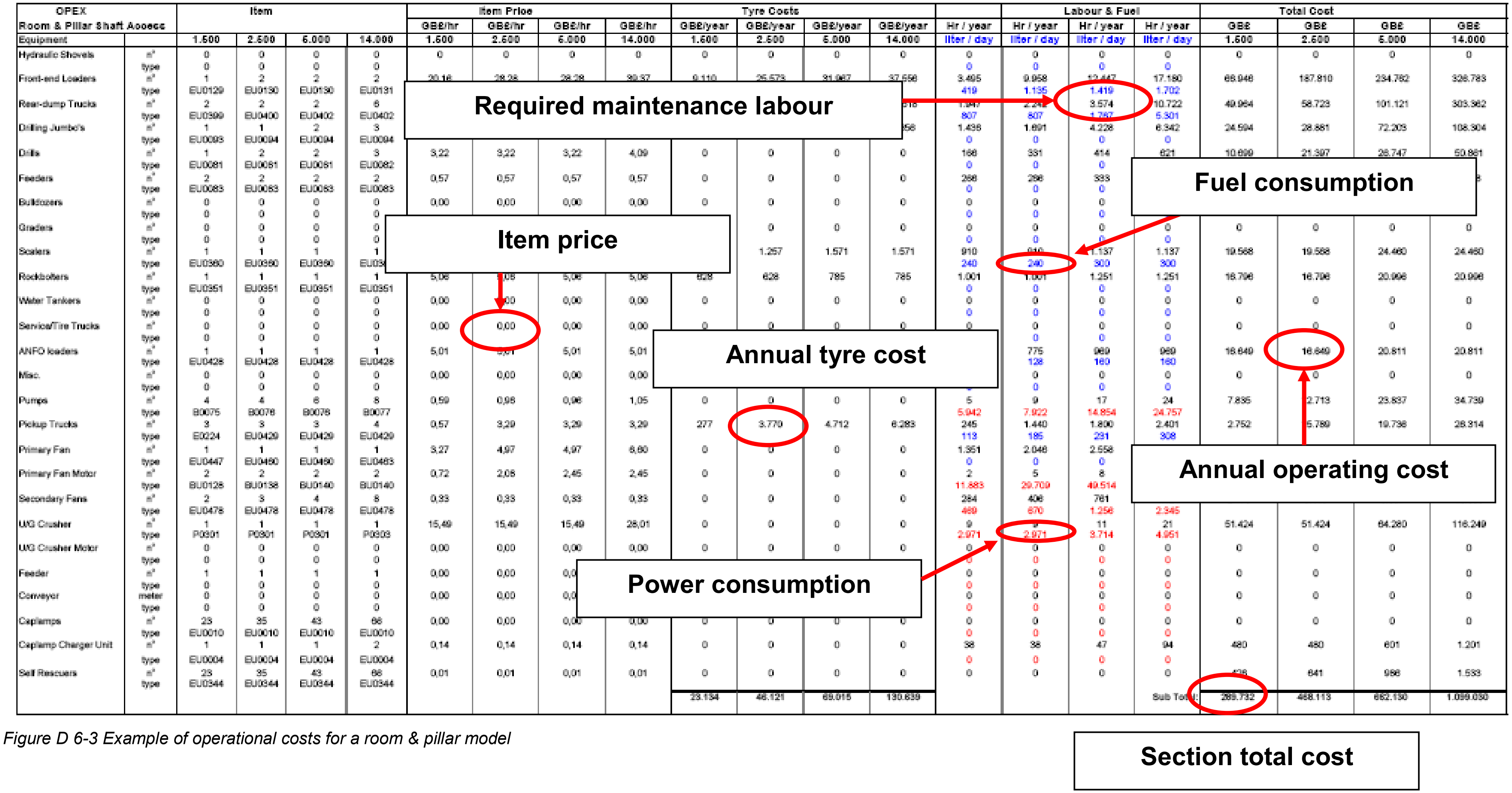


Figure D 6-3 Example of operational costs for a room & pillar model

OPEX Room & Pillar Shaft Access		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.600	2.600	6.000	14.000	1.600	2.600	6.000	14.000	1.600	2.600	6.000	14.000	liter / day	liter / day	liter / day	liter / day	1.600	2.600	6.000	14.000
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Workshop	m²	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m²	848	1500	2200	3275	15,09	15,09	15,09	15,09									[illegible]	[illegible]	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m²	500	900	1400	2000	6,44	6,44	6,44	6,44									[illegible]	[illegible]	9.016,00	12.880,00
	type	B0088	B0088	B0088	B0088																
Stores	m²	321	500	800	750	3,62	3,62	3,62	3,62									[illegible]	[illegible]	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m²	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m²	185	280	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084																
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	18.383									8.454,22	8.454	8.454	18.383
																	Sub Total:	30.251	46.347	65.124	96.882
Consumables																					
Diesel Fuel	liter/day	1.707	2.494	3.876	7.771	[illegible]	[illegible]	[illegible]	[illegible]					1.707	2.494	3.876	7.771	324.305	473.817	736.423	1.476.435
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	15.767	30.107	56.123	94.941	0,08	0,08	0,08	0,08					[illegible] 12.759	41.272 24.763	[illegible] 41.603	81.568 48.941	307.457	587.089	1.094.402	1.851.347
	type	C0002	C0002	C0002	C0002																
Explosives	kg/day	1.297	2.271	4.541	12.109	0,50	0,50	0,50	0,50									162.180	283.815	567.630	1.513.650
	type	C0003	C0003	C0003	C0003																
Caps	#/day	126	126	210	210	1,50	1,50	1,50	1,50									47.170	47.170	78.616	78.616
	type	C0004	C0004	C0004	C0004																
Primers	#/day	126	126	210	210	2,30	2,30	2,30	2,30									72.327	72.327	120.545	120.545
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	600	600	900	900	0,25	0,25	0,25	0,25									37.500	37.500	58.250	58.250
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	23.134	46.121	69.015	130.839									23.134	46.121	69.015	130.839
																	Sub Total:	1.066.288	1.640.053	2.874.981	5.379.613
Personal Hourly Rate																					
Drillers	n°	2	2	4	2	[illegible]	[illegible]	[illegible]	[illegible]									100.000	100.000	250.000	125.000
Blasters	n°	0	2	2	2	[illegible]	[illegible]	[illegible]	[illegible]									0	100.000	125.000	125.000
Excavator Operators	n°	2	4	4	4	[illegible]	[illegible]	[illegible]	[illegible]									85.000	170.000	212.500	212.500
Truck Drivers	n°	4	4	4	12	[illegible]	[illegible]	[illegible]	[illegible]									170.000	170.000	212.500	637.500
Equipment Operators	n°	2	3	4	6	10,00	10,00	10,00	10,00									80.000	120.000	200.000	300.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	6	11	12	18	12,50	12,50	12,50	12,50					11.892	21.060	29.509	45.834	297.289	527.258	737.714	1.145.846
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Geologist	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									[illegible]	[illegible]	[illegible]	[illegible]
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									[illegible]	[illegible]	[illegible]	[illegible]
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									[illegible]	[illegible]	[illegible]	[illegible]
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									[illegible]	[illegible]	[illegible]	[illegible]
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									[illegible]	[illegible]	[illegible]	[illegible]
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	1.016.289	[illegible]	2.273.714	3.245.596
																	Total Operational: Incl. Equipment	2.402.680	3.877.769	5.875.950	9.821.101	GB£

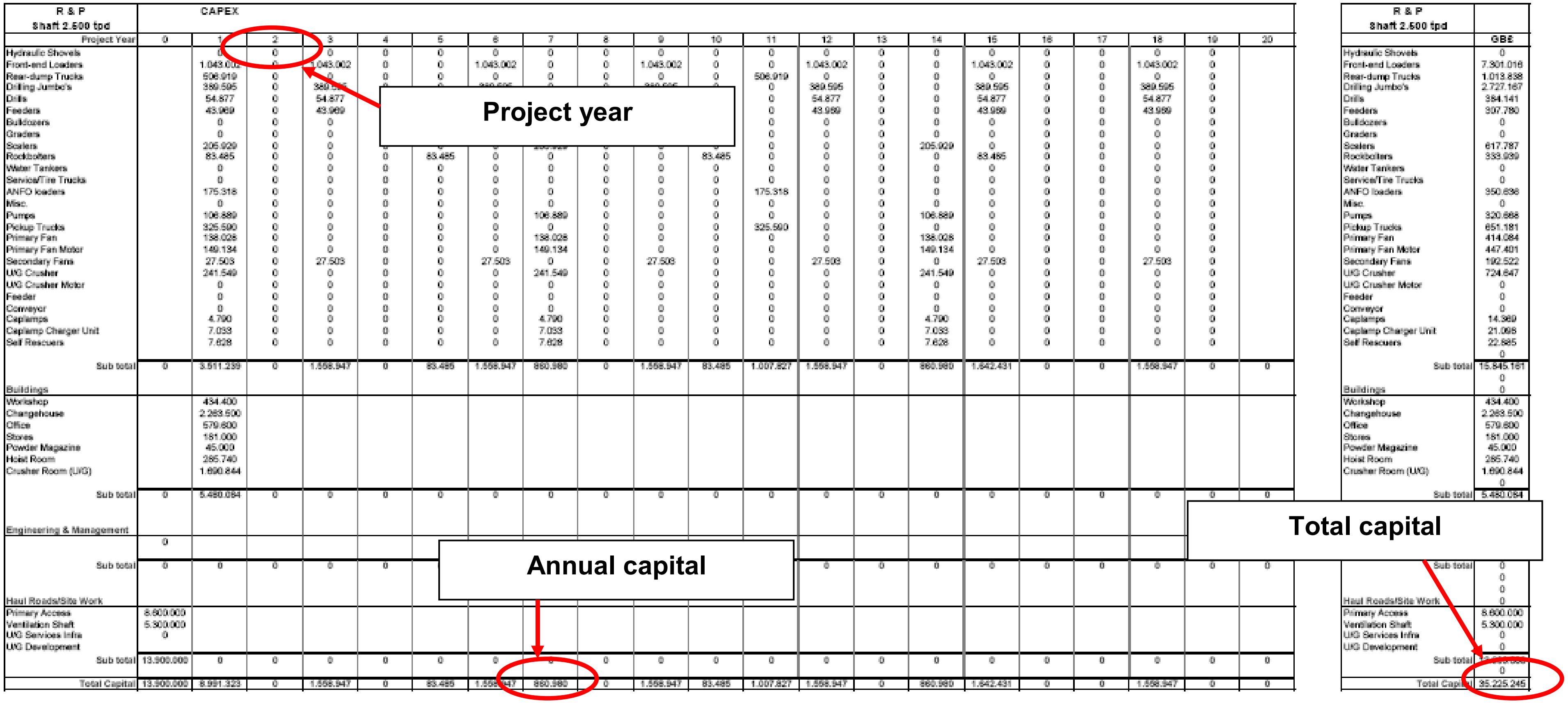
Power consumed

Fuel consumed

Required annual maintenace hours

Total operational cost

Figure D 6-3 Continued example of operational costs for a room & pillar model



R & P Shaft 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	
Rear-dump Trucks		506.919	0	0	0	0	0	0	0	0	0	506.919	0	0	0	0	0	0	0	0	
Drilling Jumbo's		389.595	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	389.595	0	0	389.595	0	0	389.595	0	
Drills		54.877	0	54.877	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.989	0	43.989	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	43.989	0	0	43.989	0	0	43.989	0	
Bulldozers		0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		106.889	0	0	0	0	0	106.889	0	0	0	0	0	0	106.889	0	0	0	0	0	
Pickup Trucks		325.590	0	0	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		4.790	0	0	0	0	0	4.790	0	0	0	0	0	0	4.790	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		7.628	0	0	0	0	0	7.628	0	0	0	0	0	0	7.628	0	0	0	0	0	
Sub total	0	3.511.239	0	1.558.947	0	83.485	1.558.947	880.980	0	1.558.947	83.485	1.007.827	1.558.947	0	880.980	1.642.431	0	0	1.558.947	0	0
Buildings																					
Workshop		434.400																			
Changehouse		2.283.500																			
Office		579.800																			
Stores		181.000																			
Powder Magazine		45.000																			
Hoist Room		285.740																			
Crusher Room (U/G)		1.690.844																			
Sub total	0	5.480.084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Engineering & Management																					
	0																				
Sub total	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0
Haul Roads/Site Work																					
Primary Access	8.600.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	13.900.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Capital	13.900.000	8.991.323	0	1.558.947	0	83.485	[illegible]	880.980	0	1.558.947	83.485	1.007.827	1.558.947	0	880.980	1.642.431	0	0	1.558.947	0	0

R & P Shaft 2.500 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	7.301.016
Rear-dump Trucks	1.013.838
Drilling Jumbo's	2.727.167
Drills	384.141
Feeders	307.780
Bulldozers	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	320.666
Pickup Trucks	651.181
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	14.369
Caplamp Charger Unit	21.098
Self Rescuers	22.885
	0
Sub total	15.845.161
	0
Buildings	0
Workshop	434.400
Changehouse	2.283.500
Office	579.800
Stores	181.000
Powder Magazine	45.000
Hoist Room	285.740
Crusher Room (U/G)	1.690.844
	0
Sub total	5.480.084
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	8.600.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	[illegible]
	0
Total Capital	35.225.245

Figure D 6-4 Example of a schedule of capital expenditure for a room & pillar model

D 6.7 Listing of appendices containing cost models

The mining cost models are presented in appendices E, F and H. The processing cost models and flow sheets are presented in appendix G.

Appendix E:

Appendix F:

Appendix G:

Appendix H

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix E1

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	mton	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
width	meter	12,0	12,0	14,0	14,0	14,0	14,0	14,0	14,0
height	meter	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
cross-sectional area	m2	96,0	96,0	112,0	112,0	112,0	112,0	112,0	112,0
Rock density	tonne/m3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Daily Advance	meter	6	6	8	8	17	17	47	47
Depth of pull	meter	3	3	3	3	4	4	6	6
No. Faces	No.	2	2	3	3	4	4	8	8
Blast size	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Pulls per day	No.	2	2	3	3	4	4	8	8
Total Resource:									
Blast size:	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Powder factor:	kg/tonne	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Drill factor:	m/tonne								
Number of holes	No.	64	64,00	75	75	56	56	75	75
Reamer holes	No.	5	5	5	5	5	5	5	5
Total Number of holes	No.	69	69	80	80	61	61	80	80
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Primary Openings	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0043	UA0038	UA0043	UA0039	UA0043	UA0040	UA0043	UA0041
Ventilation Shafts	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0
Equipment									
Hydraulic Shovels	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0129	EU0129	EU0130	EU0130	EU0130	EU0130	EU0131	EU0131
Rear-dump Trucks	no	2	2	2	2	2	2	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Drilling Jumbo's	no	1	1	1	1	2	2	3	3
	type	EU0093	EU0093	EU0094	EU0094	EU0094	EU0094	EU0094	EU0094
Drills	no	1	1	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083
Bulldozers	no								
	type								
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	1	1
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	1	1
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	4	4	4	4	6	6	8	8
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	3	3	3	4	4
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	no	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	no	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	no	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	no	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	no	1	1	1	1	1	1	1	1
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	no	31	23	42	35	50	43	75	66
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	no	1	1	1	1	1	1	2	2
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	no	31	23	42	35	50	43	75	66
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Buildings									
Workshop	m2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	500	500	900	900	1.400	1.400	2.000	2.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	no	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	1.576	1.707	2.857	2.494	3.554	3.876	6.423	7.771
Electricity (Incl. Hoisting)	kWh/day	13.650	18.775	25.654	35.451	44.574	70.643	54.140	140.941
Hoisting:	kWh/day	0	3.008	0	5.344	0	14.520	0	46.000
Explosives	kg/face	649	649	757	757	757	757	1.514	1.514
Powder	kg/day	1.297	1.297	2.271	2.271	4.541	4.541	12.109	12.109
Caps	#/face	64	64	75	75	56	56	75	75
Caps	#/day	126	126	210	210	236	236	587	587
Primers	#/face	64	64	75	75	56	56	75	75
Primers	#/day	126	126	210	210	236	236	587	587
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	600	600	900	900	1.200	1.200	2.400	2.400
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	no	2	2	2	2	4	4	6	6
Blasters	no			2	2	2	2	2	2
Excavator Operators	no	2	2	4	4	4	4	4	4
Truck Drivers	no	4	4	4	4	4	4	12	12
Equipment Operators	no	2	2	3	3	4	4	6	6
Utility Operators	no	1	1	1	1	1	1	1	1
Mechanics	no	13	6	17	11	19	12	26	18
Laborers/Maintenance	no	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	no	1	1	1	1	1	1	1	1
Superintendent	no							1	1
Foreman	no	1	1	1	1	2	2	2	2
Engineer	no			1	1	1	1	1	1
Geologist	no								
Supervisor	no								
Technician	no								
Accountant	no								
Clerk	no								
Personnel	no								
Secretary	no								
Security	no								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		28	21	38	32	46	39	68	60

CAPEX Room & Pillar Shaft Access		Item				Item Price				Total Costs				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Hydraulic Shovels	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	366.220	521.501	521.501	755.815	366.220	1.043.002	1.043.002	1.511.630	3	3	2	2
	type	EU0129	EU0130	EU0130	EU0131												
Rear-dump Trucks	n°	2	2	2	6	220.177	253.460	323.587	323.587	440.354	506.919	647.173	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Drilling Jumbo's	n°	1	1	2	3	330.599	389.595	389.595	389.595	330.599	389.595	779.191	1.168.786	3	3	2	2
	type	EU0093	EU0094	EU0094	EU0094												
Drills	n°	1	2	2	3	27.439	27.439	27.439	27.439	27.439	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	21.984	21.984	43.969	43.969	43.969	43.969	3	3	2	2
	type	EU0083	EU0083	EU0083	EU0083												
Bulldozers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Graders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Scalers	n°	1	1	1	1	205.929	205.929	205.929	205.929	205.929	205.929	205.929	205.929	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	1	175.318	175.318	175.318	175.318	175.318	175.318	175.318	175.318	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	4	4	6	8	16.308	26.722	26.722	29.045	65.234	106.889	160.334	232.359	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	3	3	4	15.027	108.530	108.530	108.530	45.082	325.590	325.590	434.121	11	11	9	9
	type	E0224	EU0429	EU0429	EU0429												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Caplamps	n°	23	35	43	66	138	138	138	138	3.180	4.790	5.892	9.160	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	1	1	2	7.033	7.033	7.033	7.033	7.033	7.033	7.033	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	23	35	43	66	220	220	220	220	5.065	7.628	9.384	14.590	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										2.202.210	**3.511.239**	**4.137.888**	**6.821.262**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Shaft Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m^2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m^2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m^2	500	900	1.400	2.000	644	644	644	644	322.000	579.600	901.600	1.288.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m^2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m^2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m^2	185	260	410	800	1.099	1.099	1.099	1.099	203.315	285.740	450.590	879.200				
	type	B0084	B0084	B0084	B0084												
Crusher Room (U/G)	n^o	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**3.870.517**	**5.480.084**	**7.357.834**	**11.322.476**				
Working Capital																	
25% of OPEX																	
									Sub Total:	**0**	**0**	**0**	**0**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1	1	1	1	6.900.000	8.600.000	12.900.000	29.900.000	6.900.000	8.600.000	12.900.000	29.900.000	20	20	20	20
Sinking Code	type	UA0038	UA0039	UA0040	UA0041												
Mob. / Demob.										0	0	0	0				
Sink Costs										0	0	0	0				
Ventilation Shafts	no	1	1	1	1	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	20	20	20	20
Sinking Code	type	UA0037	UA0037	UA0037	UA0037												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
										12.200.000	**13.900.000**	**18.200.000**	**35.200.000**				

Total Capital: Incl. Equipment	**18.272.727**	**22.891.323**	**29.695.722**	**53.343.738**	**GB£**

OPEX		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Room & Pillar Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Hydraulic Shovels	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	20,16	28,28	28,28	39,37	9.110	25.573	31.967	37.556	3.495	9.958	12.447	17.180	66.946	187.810	234.762	326.783
	type	EU0129	EU0130	EU0130	EU0131									419	1.135	1.419	1.702				
Rear-dump Trucks	nº	2	2	2	6	7,52	8,84	12,18	12,18	9.978	13.008	26.839	80.518	1.947	2.242	3.574	10.722	49.964	58.723	101.121	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	807	1.767	5.301				
Drilling Jumbo's	nº	1	1	2	3	7,41	8,70	8,70	8,70	628	628	1.571	2.356	1.436	1.691	4.228	6.342	24.594	28.881	72.203	108.304
	type	EU0093	EU0094	EU0094	EU0094									0	0	0	0				
Drills	nº	1	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	166	331	414	621	10.699	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	nº	2	2	2	2	0,57	0,57	0,57	0,57	0	0	0	0	266	266	333	333	3.806	3.806	4.758	4.758
	type	EU0083	EU0083	EU0083	EU0083									0	0	0	0				
Bulldozers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Graders	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Scalers	nº	1	1	1	1	5,89	5,89	5,89	5,89	1.257	1.257	1.571	1.571	910	910	1.137	1.137	19.568	19.568	24.460	24.460
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	300				
Rockbolters	nº	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	nº	1	1	1	1	5,01	5,01	5,01	5,01	1.257	1.257	1.571	1.571	775	775	969	969	16.649	16.649	20.811	20.811
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	160				
Misc.	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Pumps	nº	4	4	6	8	0,59	0,96	0,96	1,05	0	0	0	0	5	9	17	24	7.835	12.713	23.837	34.739
	type	B0075	B0076	B0076	B0077									5.942	7.922	14.854	24.757				
Pickup Trucks	nº	3	3	3	4	0,57	3,29	3,29	3,29	277	3.770	4.712	6.283	245	1.440	1.800	2.401	2.752	15.789	19.736	26.314
	type	E0224	EU0429	EU0429	EU0429									113	185	231	308				
Primary Fan	nº	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	nº	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	nº	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	nº	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	nº	1	1	1	1	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Caplamps	nº	23	35	43	66	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	nº	1	1	1	2	0,14	0,14	0,14	0,14	0	0	0	0	38	38	47	94	480	480	601	1.201
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	nº	23	35	43	66	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	426	641	986	1.533
	type	EU0344	EU0344	EU0344	EU0344																
										23.134	**46.121**	**69.015**	**130.639**				**Sub Total:**	**289.732**	**468.113**	**662.130**	**1.099.030**

OPEX		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Room & Pillar Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	500	900	1400	2000	6,44	6,44	6,44	6,44									3.220,00	5.796,00	9.016,00	12.880,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	185	260	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084																
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**30.251**	**46.347**	**65.124**	**96.862**
Consumables																					
Diesel Fuel	liter/day	1.707	2.494	3.876	7.771	0,76	0,76	0,76	0,76					1.707	2.494	3.876	7.771	324.305	473.817	736.423	1.476.435
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	15.767	30.107	56.123	94.941	0,08	0,08	0,08	0,08					21.265	41.272	69.339	81.568	307.457	587.089	1.094.402	1.851.347
	type	C0002	C0002	C0002	C0002									**12.759**	**24.763**	**41.603**	**48.941**				
Explosives	kg/day	1.297	2.271	4.541	12.109	0,50	0,50	0,50	0,50									162.180	283.815	567.630	1.513.680
	type	C0003	C0003	C0003	C0003																
Caps	#/day	126	126	210	210	1,50	1,50	1,50	1,50									47.170	47.170	78.616	78.616
	type	C0004	C0004	C0004	C0004																
Primers	#/day	126	126	210	210	2,30	2,30	2,30	2,30									72.327	72.327	120.545	120.545
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	600	600	900	900	0,25	0,25	0,25	0,25									37.500	37.500	56.250	56.250
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	23.134	46.121	69.015	130.639									23.134	46.121	69.015	130.639
																	Sub Total:	**1.066.288**	**1.640.053**	**2.874.981**	**5.379.613**
Personal Hourly Rate																					
Drillers	n°	2	2	4	2	12,50	12,50	12,50	12,50									100.000	100.000	250.000	125.000
Blasters	n°	0	2	2	2	12,50	12,50	12,50	12,50									0	100.000	125.000	125.000
Excavator Operators	n°	2	4	4	4	10,63	10,63	10,63	10,63									85.000	170.000	212.500	212.500
Truck Drivers	n°	4	4	4	12	10,63	10,63	10,63	10,63									170.000	170.000	212.500	637.500
Equipment Operators	n°	2	3	4	6	10,00	10,00	10,00	10,00									80.000	120.000	200.000	300.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	6	11	12	18	12,50	12,50	12,50	12,50					11.892	21.090	29.509	45.834	297.289	527.256	737.714	1.145.846
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Geologist	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**1.016.289**	**1.523.256**	**2.273.714**	**3.245.596**

Total Operational: Incl. Equipment	**2.402.560**	**3.677.769**	**5.875.950**	**9.821.101**	**GB£**

R & P Shaft 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		366.220	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Drilling Jumbo's		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		27.439	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		65.234	0	0	0	0	0	65.234	0	0	0	0	0	0	65.234	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		3.180	0	0	0	0	0	3.180	0	0	0	0	0	0	3.180	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		5.065	0	0	0	0	0	5.065	0	0	0	0	0	0	5.065	0	0	0	0	0	
Sub total	**0**	**2.202.210**	**0**	**787.479**	**0**	**83.485**	**787.479**	**670.493**	**0**	**787.479**	**83.485**	**660.754**	**787.479**	**0**	**670.493**	**870.963**	**0**	**0**	**787.479**	**0**	**0**
Buildings																					
Workshop		236.024																			
Changehouse		1.279.632																			
Office		322.000																			
Stores		116.202																			
Powder Magazine		22.500																			
Hoist Room		203.315																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**3.870.517**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	6.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**12.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**12.200.000**	**6.072.727**	**0**	**787.479**	**0**	**83.485**	**787.479**	**670.493**	**0**	**787.479**	**83.485**	**660.754**	**787.479**	**0**	**670.493**	**870.963**	**0**	**0**	**787.479**	**0**	**0**

R & P Shaft 1.500 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	2.563.537
Rear-dump Trucks	880.708
Drilling Jumbo's	2.314.196
Drills	192.070
Feeders	307.780
Bulldozers	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	195.702
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	9.541
Caplamp Charger Unit	21.098
Self Rescuers	15.196
	0
Sub total	9.179.275
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	322.000
Stores	116.202
Powder Magazine	22.500
Hoist Room	203.315
Crusher Room (U/G)	1.690.844
	0
Sub total	3.870.517
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	6.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	12.200.000
	0
Total Capital	25.249.792

R & P Shaft 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	
Rear-dump Trucks		506.919	0	0	0	0	0	0	0	0	0	506.919	0	0	0	0	0	0	0	0	
Drilling Jumbo's		389.595	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		106.889	0	0	0	0	0	106.889	0	0	0	0	0	0	106.889	0	0	0	0	0	
Pickup Trucks		325.590	0	0	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		4.790	0	0	0	0	0	4.790	0	0	0	0	0	0	4.790	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		7.628	0	0	0	0	0	7.628	0	0	0	0	0	0	7.628	0	0	0	0	0	
Sub total	**0**	**3.511.239**	**0**	**1.558.947**	**0**	**83.485**	**1.558.947**	**860.980**	**0**	**1.558.947**	**83.485**	**1.007.827**	**1.558.947**	**0**	**860.980**	**1.642.431**	**0**	**0**	**1.558.947**	**0**	**0**
Buildings																					
Workshop		434.400																			
Changehouse		2.263.500																			
Office		579.600																			
Stores		181.000																			
Powder Magazine		45.000																			
Hoist Room		285.740																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**5.480.084**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	8.600.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**13.900.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.900.000**	**8.991.323**	**0**	**1.558.947**	**0**	**83.485**	**1.558.947**	**860.980**	**0**	**1.558.947**	**83.485**	**1.007.827**	**1.558.947**	**0**	**860.980**	**1.642.431**	**0**	**0**	**1.558.947**	**0**	**0**

R & P Shaft 2.500 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	7.301.016
Rear-dump Trucks	1.013.838
Drilling Jumbo's	2.727.167
Drills	384.141
Feeders	307.780
Bulldozers	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	320.668
Pickup Trucks	651.181
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	14.369
Caplamp Charger Unit	21.098
Self Rescuers	22.885
	0
Sub total	15.845.161
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	579.600
Stores	181.000
Powder Magazine	45.000
Hoist Room	285.740
Crusher Room (U/G)	1.690.844
	0
Sub total	5.480.084
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	8.600.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	13.900.000
	0
Total Capital	35.225.245

R & P Shaft 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		647.173	0	0	0	0	0	0	0	647.173	0	0	0	0	0	0	0	0	647.173	0	
Drilling Jumbo's		779.191	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	0	0	0	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		160.334	0	0	0	0	160.334	0	0	0	0	0	160.334	0	0	0	0	0	160.334	0	
Pickup Trucks		325.590	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	325.590	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		5.892	0	0	0	5.892	0	0	0	0	5.892	0	0	0	0	5.892	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		9.384	0	0	0	0	9.384	0	0	0	0	0	9.384	0	0	0	0	0	9.384	0	
Sub total	**0**	**4.137.888**	**1.962.294**	**0**	**2.045.778**	**356.881**	**2.549.441**	**0**	**2.045.778**	**1.148.082**	**2.319.175**	**0**	**2.632.925**	**0**	**1.962.294**	**356.881**	**83.485**	**0**	**1.735.229**	**0**	**0**
Buildings																					
Workshop		615.400																			
Changehouse		3.319.800																			
Office		901.600																			
Stores		289.600																			
Powder Magazine		90.000																			
Hoist Room		450.590																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**7.357.834**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	12.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**18.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**18.200.000**	**11.495.722**	**1.962.294**	**0**	**2.045.778**	**356.881**	**2.549.441**	**0**	**2.045.778**	**1.148.082**	**2.319.175**	**0**	**2.632.925**	**0**	**1.962.294**	**356.881**	**83.485**	**0**	**1.735.229**	**0**	**0**

R & P Shaft 5.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.344.019
Rear-dump Trucks	1.941.520
Drilling Jumbo's	6.233.525
Drills	439.018
Feeders	351.749
Bulldozers	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	641.336
Pickup Trucks	976.771
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	23.566
Caplamp Charger Unit	28.131
Self Rescuers	37.535
	0
Sub total	23.336.131
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	901.600
Stores	289.600
Powder Magazine	90.000
Hoist Room	450.590
Crusher Room (U/G)	1.690.844
	0
Sub total	7.357.834
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	12.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	18.200.000
	0
Total Capital	48.893.965

R & P Shaft 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	506.919	0	0	0	0	0	0	0	0	506.919	0	
Drilling Jumbo's		1.168.786	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	0	0	0	0	
Drills		82.316	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		232.359	0	0	0	0	106.889	0	0	0	0	0	106.889	0	0	0	0	0	106.889	0	
Pickup Trucks		434.121	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	325.590	0	
Primary Fan		183.611	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	149.134	0	0	0	0	0	149.134	0	0	0	0	0	149.134	0	
Secondary Fans		77.009	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		9.160	0	0	0	4.790	0	0	0	0	4.790	0	0	0	0	4.790	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		14.590	0	0	0	0	7.628	0	0	0	0	0	7.628	0	0	0	0	0	7.628	0	
Sub total	**0**	**6.821.262**	**1.558.947**	**0**	**1.642.431**	**355.779**	**2.064.147**	**0**	**1.642.431**	**1.007.827**	**1.914.726**	**0**	**2.147.632**	**0**	**1.558.947**	**355.779**	**83.485**	**0**	**1.513.028**	**0**	**0**
Buildings																					
Workshop		579.200																			
Changehouse		4.941.975																			
Office		1.288.000																			
Stores		271.500																			
Powder Magazine		90.000																			
Hoist Room		879.200																			
Crusher Room (U/G)		3.272.601																			
Sub total	**0**	**11.322.476**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	29.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**35.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**35.200.000**	**18.143.738**	**1.558.947**	**0**	**1.642.431**	**355.779**	**2.064.147**	**0**	**1.642.431**	**1.007.827**	**1.914.726**	**0**	**2.147.632**	**0**	**1.558.947**	**355.779**	**83.485**	**0**	**1.513.028**	**0**	**0**

R & P Shaft 14.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.812.646
Rear-dump Trucks	2.955.359
Drilling Jumbo's	3.895.953
Drills	466.457
Feeders	351.749
Bulldozers	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	553.027
Pickup Trucks	1.085.301
Primary Fan	597.695
Primary Fan Motor	623.281
Secondary Fans	269.531
U/G Crusher	1.192.162
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	23.529
Caplamp Charger Unit	35.164
Self Rescuers	37.476
	0
Sub total	22.666.424
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	1.288.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	879.200
Crusher Room (U/G)	3.272.601
	0
Sub total	11.322.476
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	29.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	35.200.000
	0
Total Capital	69.188.899

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix E2

Disclaimer
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May 2010

Room & Pillar		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	mton	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
width	meter	12,0	12,0	14,0	14,0	14,0	14,0	14,0	14,0
height	meter	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
cross-sectional area	m2	96,0	96,0	112,0	112,0	112,0	112,0	112,0	112,0
Rock density	tonne/m3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Daily Advance	meter	6	6	8	8	17	17	47	47
Depth of pull	meter	3	3	3	3	4	4	6	6
No. Faces	No.	2	2	3	3	4	4	8	8
Blast size	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Pulls per day	No.	2	2	3	3	4	4	8	8
Total Resource:									
Blast size:	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Powder factor:	kg/tonne	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Drill factor:	m/tonne								
Number of holes	No.	64	64,00	75	75	56	56	75	75
Reamer holes	No.	5	5	5	5	5	5	5	5
Total Number of holes	No.	69	69	80	80	61	61	80	80
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Primary Openings	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0043	UA0038	UA0043	UA0039	UA0043	UA0040	UA0043	UA0041
Ventilation Shafts	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0
Equipment									
Hydraulic Shovels	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0129	EU0129	EU0130	EU0130	EU0130	EU0130	EU0131	EU0131
Rear-dump Trucks	no	2	2	2	2	2	2	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Drilling Jumbo's	no	1	1	1	1	2	2	3	3
	type	EU0093	EU0093	EU0094	EU0094	EU0094	EU0094	EU0094	EU0094
Drills	no	1	1	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083
Bulldozers	no								
	type								
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	1	1
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	1	1
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	4	4	4	4	6	6	8	8
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	3	3	3	4	4
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	no	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	no	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	no	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	no	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	no	1	1	1	1	1	1	1	1
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	no	31	23	42	35	50	43	75	66
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	no	1	1	1	1	1	1	2	2
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	no	31	23	42	35	50	43	75	66
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Buildings									
Workshop	m2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	500	500	900	900	1.400	1.400	2.000	2.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	no	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	1.576	1.707	2.857	2.494	3.554	3.876	6.423	7.771
Electricity (Incl. Hoisting)	kWh/day	13.650	18.775	25.654	35.451	44.574	70.643	54.140	140.941
Hoisting:	kWh/day	0	3.008	0	5.344	0	14.520	0	46.000
Explosives	kg/face	649	649	757	757	757	757	1.514	1.514
Powder	kg/day	1.297	1.297	2.271	2.271	4.541	4.541	12.109	12.109
Caps	#/face	64	64	75	75	56	56	75	75
Caps	#/day	126	126	210	210	236	236	587	587
Primers	#/face	64	64	75	75	56	56	75	75
Primers	#/day	126	126	210	210	236	236	587	587
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	600	600	900	900	1.200	1.200	2.400	2.400
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	no	2	2	2	2	4	4	6	6
Blasters	no			2	2	2	2	2	2
Excavator Operators	no	2	2	4	4	4	4	4	4
Truck Drivers	no	4	4	4	4	4	4	12	12
Equipment Operators	no	2	2	3	3	4	4	6	6
Utility Operators	no	1	1	1	1	1	1	1	1
Mechanics	no	13	6	17	11	19	12	26	18
Laborers/Maintenance	no	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	no	1	1	1	1	1	1	1	1
Superintendent	no							1	1
Foreman	no	1	1	1	1	2	2	2	2
Engineer	no			1	1	1	1	1	1
Geologist	no								
Supervisor	no								
Technician	no								
Accountant	no								
Clerk	no								
Personnel	no								
Secretary	no								
Security	no								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		28	21	38	32	46	39	68	60

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Equipment		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Hydraulic Shovels	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	366.220	521.501	521.501	755.815	366.220	1.043.002	1.043.002	1.511.630	3	3	2	2
	type	EU0129	EU0130	EU0130	EU0131												
Rear-dump Trucks	n°	2	2	2	6	183.666	278.282	344.514	331.713	367.333	556.565	689.027	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Drilling Jumbo's	n°	1	1	2	3	330.599	389.595	389.595	389.595	330.599	389.595	779.191	1.168.786	3	3	2	2
	type	EU0093	EU0094	EU0094	EU0094												
Drills	n°	1	2	2	3	27.439	27.439	27.439	27.439	27.439	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	21.984	21.984	43.969	43.969	43.969	43.969	3	3	2	2
	type	EU0083	EU0083	EU0083	EU0083												
Bulldozers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Graders	n°	1	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	133.576	133.576	4	4	3	3
	type	EU0114	EU0114	EU0114	EU0114												
Scalers	n°	1	1	1	1	205.929	205.929	205.929	205.929	205.929	205.929	205.929	205.929	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	1	175.318	175.318	175.318	175.318	175.318	175.318	175.318	175.318	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	4	4	6	8	16.308	26.722	26.722	29.045	65.234	106.889	160.334	232.359	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	3	3	4	15.027	15.027	15.027	15.027	45.082	45.082	45.082	60.109	11	11	9	9
	type	E0224	E0224	E0224	E0224												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	1650	1650	1650	1650	1.300.222	1.300.222	1.610.863	2.001.718	1.300.222	1.300.222	1.610.863	2.001.718	7	7	6	6
	type	BU0476	BU0476	BU0484	BU0490												
Caplamps	n°	31	42	50	75	138	138	138	138	4.269	5.781	6.948	10.327	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	1	1	2	7.033	7.033	7.033	7.033	7.033	7.033	7.033	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	31	42	50	75	220	220	220	220	6.800	9.208	11.066	16.448	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										3.565.809	**4.716.745**	**5.646.411**	**8.634.324**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Adit Access						**GB£**	**GB£**	**GB£**	**GB£**	**GB£**	**GB£**	**GB£**	**GB£**	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m^2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m^2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m^2	500	900	1.400	2.000	644	644	644	644	322.000	579.600	901.600	1.288.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m^2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m^2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m^2	0	0	0	0	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
Crusher Room (U/G)	n°	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**3.667.202**	**5.194.344**	**6.907.244**	**10.443.276**				
Working Capital																	
25% of OPEX										690.239	983.621	1.454.333	2.020.977				
									Sub Total:	**690.239**	**983.621**	**1.454.333**	**2.020.977**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1.500	1.500	1.500	1.500	8.970	8.970	8.970	8.970	13.455.000	13.455.000	13.455.000	13.455.000	20	20	20	20
Sinking Code	type	UA0043	UA0043	UA0043	UA0043												
Mob. / Demob.						0	0	0	0	0	0	0	0				
Sink Costs						0	0	0	0	0	0	0	0				
Ventilation Shafts	no	1	1	1	1	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	20	20	20	20
Sinking Code	type	UA0037	UA0037	UA0037	UA0037												
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
										18.755.000	**18.755.000**	**18.755.000**	**18.755.000**				

Total Capital: Incl. Equipment	**26.678.250**	**29.649.710**	**32.762.988**	**39.853.577**	**GB£**

OPEX		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Room & Pillar Adit Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Hydraulic Shovels	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	20,16	28,28	28,28	39,37	9.110	25.573	31.967	37.556	3.495	9.958	12.447	17.180	66.946	187.810	234.762	326.783
	type	EU0129	EU0130	EU0130	EU0131									419	1.135	1.419	1.702				
Rear-dump Trucks	nº	2	2	2	6	4,78	8,02	8,99	9,39	10.385	21.693	27.116	96.039	994	1.205	1.863	5.383	31.708	53.253	74.651	233.931
	type	E0249	E0258	E0259	E0260									443	1.008	1.243	3.781				
Drilling Jumbo's	nº	1	1	2	3	7,41	8,70	8,70	8,70	628	628	1.571	2.356	1.436	1.691	4.228	6.342	24.594	28.881	72.203	108.304
	type	EU0093	EU0094	EU0094	EU0094									0	0	0	0				
Drills	nº	1	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	166	331	414	621	10.699	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	nº	2	2	2	2	0,57	0,57	0,57	0,57	0	0	0	0	266	266	333	333	3.806	3.806	4.758	4.758
	type	EU0083	EU0083	EU0083	EU0083									0	0	0	0				
Bulldozers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Graders	nº	1	1	1	1	4,33	4,33	4,33	4,33	1.035	1.035	1.293	1.293	562	562	702	702	14.376	14.376	17.970	17.970
	type	EU0114	EU0114	EU0114	EU0114									233	233	291	291				
Scalers	nº	1	1	1	1	5,89	5,89	5,89	5,89	1.257	1.257	1.571	1.571	910	910	1.137	1.137	19.568	19.568	24.460	24.460
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	300				
Rockbolters	nº	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	nº	1	1	1	1	5,01	5,01	5,01	5,01	1.257	1.257	1.571	1.571	775	775	969	969	16.649	16.649	20.811	20.811
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	160				
Misc.	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Pumps	nº	4	4	6	8	0,59	0,96	0,96	1,05	0	0	0	0	5	9	17	24	7.835	12.713	23.837	34.739
	type	B0075	B0076	B0076	B0077									5.942	7.922	14.854	24.757				
Pickup Trucks	nº	3	3	3	4	0,57	0,57	0,57	0,57	277	277	346	462	10.046	10.046	12.558	16.744	2.752	2.752	3.440	4.586
	type	E0224	E0224	E0224	E0224									113	113	142	189				
Primary Fan	nº	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	nº	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	nº	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	nº	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	nº	1	1	1	1	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	1650	1650	1650	1650	21,12	21,12	26,17	32,52	0	0	0	0	4.936	4.936	7.644	9.499	70.124	70.124	108.604	134.958
	type	BU0476	BU0476	BU0484	BU0490									1.485	1.485	4.951	8.665				
Caplamps	nº	31	42	50	75	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	nº	1	1	1	2	0,14	0,14	0,14	0,14	0	0	0	0	38	38	47	94	480	480	601	1.201
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	nº	31	42	50	75	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	572	774	1.163	1.728
	type	EU0344	EU0344	EU0344	EU0344																
										24.576	**52.348**	**66.220**	**141.633**				**Sub Total:**	**356.121**	**534.239**	**746.115**	**1.160.994**

OPEX Room & Pillar Adit Access		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	500	900	1400	2000	6,44	6,44	6,44	6,44									3.220,00	5.796,00	9.016,00	12.880,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	0	0	0	0	0,00	0,00	0,00	0,00									0,00	0,00	0,00	0,00
	type	0	0	0	0																
Crusher Room (U/G)	n^o	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**28.218**	**43.489**	**60.618**	**88.070**
Consumables																					
Diesel Fuel	liter/day	1.576	2.857	3.554	6.423	0,76	0,76	0,76	0,76					1.576	2.857	3.554	6.423	299.534	542.840	675.303	1.220.406
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	13.650	25.654	44.574	54.140	0,08	0,08	0,08	0,08					22.751	42.757	74.290	90.233	266.181	500.260	869.194	1.055.728
	type	C0002	C0002	C0002	C0002									**13.650**	**25.654**	**44.574**	**54.140**				
Explosives	kg/day	1.297	2.271	4.541	12.109	0,50	0,50	0,50	0,50									162.180	283.815	567.630	1.513.680
	type	C0003	C0003	C0003	C0003																
Caps	#/day	126	126	210	210	1,50	1,50	1,50	1,50									47.170	47.170	78.616	78.616
	type	C0004	C0004	C0004	C0004																
Primers	#/day	126	126	210	210	2,30	2,30	2,30	2,30									72.327	72.327	120.545	120.545
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	600	600	900	900	0,25	0,25	0,25	0,25									37.500	37.500	56.250	56.250
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	24.576	52.348	66.220	141.633									24.576	52.348	66.220	141.633
																	Sub Total:	**1.001.682**	**1.628.475**	**2.585.859**	**4.338.959**
Personal Hourly Rate																					
Drillers	n^o	2	2	4	2	12,50	12,50	12,50	12,50									100.000	100.000	250.000	125.000
Blasters	n^o	0	2	2	2	12,50	12,50	12,50	12,50									0	100.000	125.000	125.000
Excavator Operators	n^o	2	4	4	4	10,63	10,63	10,63	10,63									85.000	170.000	212.500	212.500
Truck Drivers	n^o	4	4	4	12	10,63	10,63	10,63	10,63									170.000	170.000	212.500	637.500
Equipment Operators	n^o	2	3	4	6	10,00	10,00	10,00	10,00									80.000	120.000	200.000	300.000
Utility Operators	n^o	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n^o	13	17	19	26	12,50	12,50	12,50	12,50					26.237	34.157	46.902	65.040	655.935	853.915	1.172.556	1.625.999
Laborers/Maintenance	n^o	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n^o	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n^o	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n^o	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n^o	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Geologist	n^o	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Supervisor	n^o	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n^o	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n^o	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n^o	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n^o	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n^o	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n^o	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**1.374.935**	**1.849.915**	**2.708.556**	**3.725.749**

Total Operational: Incl. Equipment	**2.760.956**	**4.056.119**	**6.101.149**	**9.313.773**	**GB£**

R & P Adit 1.500 tpd	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		366.220	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Drilling Jumbo's		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		27.439	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		65.234	0	0	0	0	0	65.234	0	0	0	0	0	0	65.234	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		4.269	0	0	0	0	0	4.269	0	0	0	0	0	0	4.269	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		6.800	0	0	0	0	0	6.800	0	0	0	0	0	0	6.800	0	0	0	0	0	
Sub total	**0**	**3.565.809**	**0**	**787.479**	**133.576**	**83.485**	**787.479**	**1.973.538**	**133.576**	**787.479**	**83.485**	**587.732**	**921.054**	**0**	**1.973.538**	**870.963**	**133.576**	**0**	**787.479**	**0**	**0**
Buildings																					
Workshop		236.024																			
Changehouse		1.279.632																			
Office		322.000																			
Stores		116.202																			
Powder Magazine		22.500																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**3.667.202**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**18.755.000**	**7.233.011**	**0**	**787.479**	**133.576**	**83.485**	**787.479**	**1.973.538**	**133.576**	**787.479**	**83.485**	**587.732**	**921.054**	**0**	**1.973.538**	**870.963**	**133.576**	**0**	**787.479**	**0**	**0**

R & P Adit 1.500 tpd	**GB£**
Hydraulic Shovels	0
Front-end Loaders	2.563.537
Rear-dump Trucks	734.665
Drilling Jumbo's	2.314.196
Drills	192.070
Feeders	307.780
Bulldozers	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	195.702
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	12.808
Caplamp Charger Unit	21.098
Self Rescuers	20.400
	0
Sub total	13.610.246
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	322.000
Stores	116.202
Powder Magazine	22.500
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	3.667.202
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	18.755.000
	0
Total Capital	36.032.448

R & P Adit 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	
Rear-dump Trucks		556.565	0	0	0	0	0	0	0	0	0	556.565	0	0	0	0	0	0	0	0	
Drilling Jumbo's		389.595	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		106.889	0	0	0	0	0	106.889	0	0	0	0	0	0	106.889	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		5.781	0	0	0	0	0	5.781	0	0	0	0	0	0	5.781	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		9.208	0	0	0	0	0	9.208	0	0	0	0	0	0	9.208	0	0	0	0	0	
Sub total	**0**	**4.716.745**	**0**	**1.558.947**	**133.576**	**83.485**	**1.558.947**	**2.163.773**	**133.576**	**1.558.947**	**83.485**	**776.964**	**1.692.522**	**0**	**2.163.773**	**1.642.431**	**133.576**	**0**	**1.558.947**	**0**	**0**
Buildings																					
Workshop		434.400																			
Changehouse		2.263.500																			
Office		579.600																			
Stores		181.000																			
Powder Magazine		45.000																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**5.194.344**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**18.755.000**	**9.911.089**	**0**	**1.558.947**	**133.576**	**83.485**	**1.558.947**	**2.163.773**	**133.576**	**1.558.947**	**83.485**	**776.964**	**1.692.522**	**0**	**2.163.773**	**1.642.431**	**133.576**	**0**	**1.558.947**	**0**	**0**

R & P Adit 2.500 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	7.301.016
Rear-dump Trucks	1.113.130
Drilling Jumbo's	2.727.167
Drills	384.141
Feeders	307.780
Bulldozers	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	320.668
Pickup Trucks	90.163
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	17.344
Caplamp Charger Unit	21.098
Self Rescuers	27.625
	0
Sub total	19.959.693
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	579.600
Stores	181.000
Powder Magazine	45.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	5.194.344
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	18.755.000
	0
Total Capital	43.909.037

R & P Adit 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		689.027	0	0	0	0	0	0	0	689.027	0	0	0	0	0	0	0	0	689.027	0	
Drilling Jumbo's		779.191	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	0	0	0	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		160.334	0	0	0	0	160.334	0	0	0	0	0	160.334	0	0	0	0	0	160.334	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.610.863	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	
Caplamps		6.948	0	0	0	6.948	0	0	0	0	6.948	0	0	0	0	6.948	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		11.066	0	0	0	0	11.066	0	0	0	0	0	11.066	0	0	0	0	0	11.066	0	
Sub total	**0**	**5.646.411**	**1.962.294**	**133.576**	**2.045.778**	**357.938**	**4.295.561**	**0**	**2.045.778**	**1.043.002**	**2.320.231**	**0**	**4.379.046**	**0**	**1.962.294**	**491.513**	**83.485**	**0**	**3.242.694**	**0**	**0**
Buildings																					
Workshop		615.400																			
Changehouse		3.319.800																			
Office		901.600																			
Stores		289.600																			
Powder Magazine		90.000																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**6.907.244**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**18.755.000**	**12.553.654**	**1.962.294**	**133.576**	**2.045.778**	**357.938**	**4.295.561**	**0**	**2.045.778**	**1.043.002**	**2.320.231**	**0**	**4.379.046**	**0**	**1.962.294**	**491.513**	**83.485**	**0**	**3.242.694**	**0**	**0**

R & P Adit 5.000 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	8.344.019
Rear-dump Trucks	2.067.081
Drilling Jumbo's	6.233.525
Drills	439.018
Feeders	351.749
Bulldozers	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	641.336
Pickup Trucks	135.245
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	6.443.451
Caplamps	27.792
Caplamp Charger Unit	28.131
Self Rescuers	44.265
	0
Sub total	30.009.602
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	901.600
Stores	289.600
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	6.907.244
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	18.755.000
	0
Total Capital	55.671.845

R & P Adit 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	556.565	0	0	0	0	0	0	0	0	556.565	0	
Drilling Jumbo's		1.168.786	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	0	0	0	0	
Drills		82.316	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		232.359	0	0	0	0	106.889	0	0	0	0	0	106.889	0	0	0	0	0	106.889	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		183.611	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	149.134	0	0	0	0	0	149.134	0	0	0	0	0	149.134	0	
Secondary Fans		77.009	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		2.001.718	0	0	0	0	1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	1.300.222	0	
Caplamps		10.327	0	0	0	5.781	0	0	0	0	5.781	0	0	0	0	5.781	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		16.448	0	0	0	0	9.208	0	0	0	0	0	9.208	0	0	0	0	0	9.208	0	
Sub total	**0**	**8.634.324**	**1.558.947**	**133.576**	**1.642.431**	**356.771**	**3.499.525**	**0**	**1.642.431**	**910.540**	**1.915.718**	**0**	**3.583.009**	**0**	**1.558.947**	**490.347**	**83.485**	**0**	**2.717.542**	**0**	**0**
Buildings																					
Workshop		579.200																			
Changehouse		4.941.975																			
Office		1.288.000																			
Stores		271.500																			
Powder Magazine		90.000																			
Hoist Room		0																			
Crusher Room (U/G)		3.272.601																			
Sub total	**0**	**10.443.276**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**18.755.000**	**19.077.600**	**1.558.947**	**133.576**	**1.642.431**	**356.771**	**3.499.525**	**0**	**1.642.431**	**910.540**	**1.915.718**	**0**	**3.583.009**	**0**	**1.558.947**	**490.347**	**83.485**	**0**	**2.717.542**	**0**	**0**

R & P Adit 14.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.812.646
Rear-dump Trucks	3.103.405
Drilling Jumbo's	3.895.953
Drills	466.457
Feeders	351.749
Bulldozers	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	553.027
Pickup Trucks	150.272
Primary Fan	597.695
Primary Fan Motor	623.281
Secondary Fans	269.531
U/G Crusher	1.192.162
U/G Crusher Motor	0
Feeder	0
Conveyor	5.902.383
Caplamps	27.671
Caplamp Charger Unit	35.164
Self Rescuers	44.073
	0
Sub total	28.727.593
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	1.288.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	3.272.601
	0
Sub total	10.443.276
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	0
Sub total	18.755.000
	0
Total Capital	57.925.868

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix E3

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	mton	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
width	meter	12,0	12,0	14,0	14,0	14,0	14,0	14,0	14,0
height	meter	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
cross-sectional area	m2	96,0	96,0	112,0	112,0	112,0	112,0	112,0	112,0
Rock density	tonne/m3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Daily Advance	meter	6	6	8	8	17	17	47	47
Depth of pull	meter	3	3	3	3	4	4	6	6
No. Faces	No.	2	2	3	3	4	4	8	8
Blast size	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Pulls per day	No.	2	2	3	3	4	4	8	8
Total Resource:									
Blast size:	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Powder factor:	kg/tonne	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Drill factor:	m/tonne								
Number of holes	No.	64	64,00	75	75	56	56	75	75
Reamer holes	No.	5	5	5	5	5	5	5	5
Total Number of holes	No.	69	69	80	80	61	61	80	80
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Primary Openings	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0042	UA0032	UA0042	UA0033	UA0042	UA0034	UA0042	UA0035
Ventilation Shafts	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0
Equipment									
Hydraulic Shovels	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0129	EU0129	EU0130	EU0130	EU0130	EU0130	EU0131	EU0131
Rear-dump Trucks	no	2	2	2	2	2	2	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Drilling Jumbo's	no	1	1	1	1	2	2	3	3
	type	EU0093	EU0093	EU0094	EU0094	EU0094	EU0094	EU0094	EU0094
Drills	no	1	1	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083
Bulldozers	no								
	type								
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	1	1
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	1	1
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	2	2	2	2	3	3	4	4
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	3	3	3	4	4
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	no	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	no	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	no	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	no	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	no	1	1	1	1	1	1	1	1
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	no	31	23	42	35	50	43	75	66
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	no	1	1	1	1	1	1	2	2
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	no	31	23	42	35	50	43	75	66
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Buildings									
Workshop	m2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	500	500	900	900	1.400	1.400	2.000	2.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	no	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	1.576	1.707	2.857	2.494	3.554	3.876	6.423	7.771
Electricity (Incl. Hoisting)	kWh/day	11.868	16.993	23.278	33.074	40.118	66.187	46.713	133.514
Hoisting:	kWh/day	0	3.008	0	5.344	0	14.520	0	46.000
Explosives	kg/face	649	649	757	757	757	757	1.514	1.514
Powder	kg/day	1.275	1.275	2.125	2.125	3.188	3.188	11.900	11.900
Caps	#/face	64	64	75	75	56	56	75	75
Caps	#/day	126	126	210	210	236	236	587	587
Primers	#/face	64	64	75	75	56	56	75	75
Primers	#/day	126	126	210	210	236	236	587	587
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	600	600	900	900	1.200	1.200	2.400	2.400
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	no	2	2	2	2	4	4	6	6
Blasters	no			2	2	2	2	2	2
Excavator Operators	no	2	2	4	4	4	4	4	4
Truck Drivers	no	4	4	4	4	4	4	12	12
Equipment Operators	no	2	2	3	3	4	4	6	6
Utility Operators	no	1	1	1	1	1	1	1	1
Mechanics	no	13	6	17	11	19	12	26	18
Laborers/Maintenance	no	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	no	1	1	1	1	1	1	1	1
Superintendent	no							1	1
Foreman	no	1	1	1	1	2	2	2	2
Engineer	no			1	1	1	1	1	1
Geologist	no								
Supervisor	no								
Technician	no								
Accountant	no								
Clerk	no								
Personnel	no								
Secretary	no								
Security	no								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		28	21	38	32	46	39	68	60

OPEX		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Room & Pillar Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Hydraulic Shovels	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	20,16	28,28	28,28	39,37	9.110	25.573	31.967	37.556	3.495	9.958	12.447	17.180	66.946	187.810	234.762	326.783
	type	EU0129	EU0130	EU0130	EU0131									419	1.135	1.419	1.702				
Rear-dump Trucks	nº	2	2	2	6	7,52	8,84	12,18	12,18	9.978	13.008	26.839	80.518	1.947	2.242	3.574	10.722	49.964	58.723	101.121	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	807	1.767	5.301				
Drilling Jumbo's	nº	1	1	2	3	7,41	8,70	8,70	8,70	628	628	1.571	2.356	1.436	1.691	4.228	6.342	24.594	28.881	72.203	108.304
	type	EU0093	EU0094	EU0094	EU0094									0	0	0	0				
Drills	nº	1	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	166	331	414	621	10.699	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	nº	2	2	2	2	0,57	0,57	0,57	0,57	0	0	0	0	266	266	333	333	3.806	3.806	4.758	4.758
	type	EU0083	EU0083	EU0083	EU0083									0	0	0	0				
Bulldozers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Graders	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Scalers	nº	1	1	1	1	5,89	5,89	5,89	5,89	1.257	1.257	1.571	1.571	910	910	1.137	1.137	19.568	19.568	24.460	24.460
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	300				
Rockbolters	nº	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	nº	1	1	1	1	5,01	5,01	5,01	5,01	1.257	1.257	1.571	1.571	775	775	969	969	16.649	16.649	20.811	20.811
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	160				
Misc.	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Pumps	nº	2	2	3	4	0,59	0,96	0,96	1,05	0	0	0	0	3	4	8	12	3.917	6.356	11.918	17.369
	type	B0075	B0076	B0076	B0077									2.971	3.961	7.427	12.379				
Pickup Trucks	nº	3	3	3	4	0,57	3,29	3,29	3,29	277	3.770	4.712	6.283	245	1.440	1.800	2.401	2.752	15.789	19.736	26.314
	type	E0224	EU0429	EU0429	EU0429									113	185	231	308				
Primary Fan	nº	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	nº	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	nº	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	nº	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	nº	1	1	1	1	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Caplamps	nº	23	35	43	66	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	nº	1	1	1	2	0,14	0,14	0,14	0,14	0	0	0	0	38	38	47	94	480	480	601	1.201
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	nº	23	35	43	66	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	426	641	986	1.533
	type	EU0344	EU0344	EU0344	EU0344																
										23.134	**46.121**	**69.015**	**130.639**				**Sub Total:**	**285.815**	**461.757**	**650.212**	**1.081.661**

OPEX		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
Room & Pillar Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	500	900	1400	2000	6,44	6,44	6,44	6,44									3.220,00	5.796,00	9.016,00	12.880,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	185	260	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084																
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**30.251**	**46.347**	**65.124**	**96.862**
Consumables																					
Diesel Fuel	liter/day	1.707	2.494	3.876	7.771	0,76	0,76	0,76	0,76					1.707	2.494	3.876	7.771	324.305	473.817	736.423	1.476.435
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	13.985	27.730	51.667	87.514	0,08	0,08	0,08	0,08					18.294	37.311	61.911	69.190	272.698	540.743	1.007.504	1.706.517
	type	C0002	C0002	C0002	C0002									**10.977**	**22.386**	**37.147**	**41.514**				
Explosives	kg/day	1.297	1.297	2.271	2.271	0,50	0,50	0,50	0,50									162.180	162.180	283.815	283.815
	type	C0003	C0003	C0003	C0003																
Caps	#/day	126	126	210	210	1,50	1,50	1,50	1,50									47.170	47.170	78.616	78.616
	type	C0004	C0004	C0004	C0004																
Primers	#/day	126	126	210	210	2,30	2,30	2,30	2,30									72.327	72.327	120.545	120.545
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	600	600	900	900	0,25	0,25	0,25	0,25									37.500	37.500	56.250	56.250
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	23.134	46.121	69.015	130.639									23.134	46.121	69.015	130.639
																	Sub Total:	**1.031.529**	**1.472.073**	**2.504.268**	**4.004.918**
Personal Hourly Rate																					
Drillers	n°	2	2	4	2	12,50	12,50	12,50	12,50									100.000	100.000	250.000	125.000
Blasters	n°	0	2	2	2	12,50	12,50	12,50	12,50									0	100.000	125.000	125.000
Excavator Operators	n°	2	4	4	4	10,63	10,63	10,63	10,63									85.000	170.000	212.500	212.500
Truck Drivers	n°	4	4	4	12	10,63	10,63	10,63	10,63									170.000	170.000	212.500	637.500
Equipment Operators	n°	2	3	4	6	10,00	10,00	10,00	10,00									80.000	120.000	200.000	300.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	6	11	12	18	12,50	12,50	12,50	12,50					11.889	21.086	29.500	45.822	297.220	527.144	737.504	1.145.541
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Geologist	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**1.016.220**	**1.523.144**	**2.273.504**	**3.245.291**

Total Operational:	**2.363.815**	**3.503.320**	**5.493.108**	**8.428.732**	**GB£**
Incl. Equipment					

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Shaft Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Hydraulic Shovels	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	nº	1	2	2	2	366.220	521.501	521.501	755.815	366.220	1.043.002	1.043.002	1.511.630	3	3	2	2
	type	EU0129	EU0130	EU0130	EU0131												
Rear-dump Trucks	nº	2	2	2	6	220.177	253.460	323.587	323.587	440.354	506.919	647.173	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Drilling Jumbo's	nº	1	1	2	3	330.599	389.595	389.595	389.595	330.599	389.595	779.191	1.168.786	3	3	2	2
	type	EU0093	EU0094	EU0094	EU0094												
Drills	nº	1	2	2	3	27.439	27.439	27.439	27.439	27.439	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	nº	2	2	2	2	21.984	21.984	21.984	21.984	43.969	43.969	43.969	43.969	3	3	2	2
	type	EU0083	EU0083	EU0083	EU0083												
Bulldozers	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Graders	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Scalers	nº	1	1	1	1	205.929	205.929	205.929	205.929	205.929	205.929	205.929	205.929	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	nº	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	nº	1	1	1	1	175.318	175.318	175.318	175.318	175.318	175.318	175.318	175.318	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	nº	2	2	3	4	16.308	26.722	26.722	29.045	32.617	53.445	80.167	116.180	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	nº	3	3	3	4	15.027	108.530	108.530	108.530	45.082	325.590	325.590	434.121	11	11	9	9
	type	E0224	EU0429	EU0429	EU0429												
Primary Fan	nº	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	nº	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	nº	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	nº	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	nº	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Caplamps	nº	23	35	43	66	138	138	138	138	3.180	4.789	5.891	9.160	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	nº	1	1	1	2	7.033	7.033	7.033	7.033	7.033	7.033	7.033	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	nº	23	35	43	66	220	220	220	220	5.065	7.628	9.383	14.589	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										2.169.592	**3.457.793**	**4.057.720**	**6.705.081**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Shaft Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m^2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m^2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m^2	500	900	1.400	2.000	644	644	644	644	322.000	579.600	901.600	1.288.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m^2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m^2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m^2	185	260	410	800	1.099	1.099	1.099	1.099	203.315	285.740	450.590	879.200				
	type	B0084	B0084	B0084	B0084												
Crusher Room (U/G)	n^o	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**3.870.517**	**5.480.084**	**7.357.834**	**11.322.476**				
Working Capital																	
25% of OPEX																	
									Sub Total:	**0**	**0**	**0**	**0**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1	1	1	1	5.200.000	7.000.000	11.300.000	28.200.000	5.200.000	7.000.000	11.300.000	28.200.000	20	20	20	20
Sinking Code	type	UA0032	UA0033	UA0034	UA0035												
Mob. / Demob.										0	0	0	0				
Sink Costs										0	0	0	0				
Ventilation Shafts	no	1	1	1	1	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	20	20	20	20
Sinking Code	type	UA0036	UA0036	UA0036	UA0036												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
										9.200.000	**11.000.000**	**15.300.000**	**32.200.000**				

Total Capital: Incl. Equipment	**15.240.109**	**19.937.877**	**26.715.554**	**50.227.557**	**GB£**

R & P Shaft 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		366.220	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Drilling Jumbo's		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		27.439	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		32.617	0	0	0	0	0	32.617	0	0	0	0	0	0	32.617	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		3.180	0	0	0	0	0	3.180	0	0	0	0	0	0	3.180	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		5.065	0	0	0	0	0	5.065	0	0	0	0	0	0	5.065	0	0	0	0	0	
Sub total	**0**	**2.169.592**	**0**	**787.479**	**0**	**83.485**	**787.479**	**637.876**	**0**	**787.479**	**83.485**	**660.754**	**787.479**	**0**	**637.876**	**870.963**	**0**	**0**	**787.479**	**0**	**0**
Buildings																					
Workshop		236.024																			
Changehouse		1.279.632																			
Office		322.000																			
Stores		116.202																			
Powder Magazine		22.500																			
Hoist Room		203.315																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**3.870.517**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	5.200.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**9.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**9.200.000**	**6.040.109**	**0**	**787.479**	**0**	**83.485**	**787.479**	**637.876**	**0**	**787.479**	**83.485**	**660.754**	**787.479**	**0**	**637.876**	**870.963**	**0**	**0**	**787.479**	**0**	**0**

R & P Shaft 1.500 tpd	GB£
Hydraulic Shovels	0
Front-end Loaders	2.563.537
Rear-dump Trucks	880.708
Drilling Jumbo's	2.314.196
Drills	192.070
Feeders	307.780
Bulldozers	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	97.851
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	9.540
Caplamp Charger Unit	21.098
Self Rescuers	15.195
	0
Sub total	9.081.423
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	322.000
Stores	116.202
Powder Magazine	22.500
Hoist Room	203.315
Crusher Room (U/G)	1.690.844
	0
Sub total	3.870.517
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	5.200.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	9.200.000
	0
Total Capital	22.151.939

R & P Shaft 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	
Rear-dump Trucks		506.919	0	0	0	0	0	0	0	0	0	506.919	0	0	0	0	0	0	0	0	
Drilling Jumbo's		389.595	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		53.445	0	0	0	0	0	53.445	0	0	0	0	0	0	53.445	0	0	0	0	0	
Pickup Trucks		325.590	0	0	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		4.789	0	0	0	0	0	4.789	0	0	0	0	0	0	4.789	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		7.628	0	0	0	0	0	7.628	0	0	0	0	0	0	7.628	0	0	0	0	0	
Sub total	**0**	**3.457.793**	**0**	**1.558.947**	**0**	**83.485**	**1.558.947**	**807.534**	**0**	**1.558.947**	**83.485**	**1.007.827**	**1.558.947**	**0**	**807.534**	**1.642.431**	**0**	**0**	**1.558.947**	**0**	**0**
Buildings																					
Workshop		434.400																			
Changehouse		2.263.500																			
Office		579.600																			
Stores		181.000																			
Powder Magazine		45.000																			
Hoist Room		285.740																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**5.480.084**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	7.000.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**11.000.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**11.000.000**	**8.937.877**	**0**	**1.558.947**	**0**	**83.485**	**1.558.947**	**807.534**	**0**	**1.558.947**	**83.485**	**1.007.827**	**1.558.947**	**0**	**807.534**	**1.642.431**	**0**	**0**	**1.558.947**	**0**	**0**

R & P Shaft 2.500 tpd	**GB£**
Hydraulic Shovels	0
Front-end Loaders	7.301.016
Rear-dump Trucks	1.013.838
Drilling Jumbo's	2.727.167
Drills	384.141
Feeders	307.780
Bulldozers	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	160.334
Pickup Trucks	651.181
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	14.368
Caplamp Charger Unit	21.098
Self Rescuers	22.884
	0
Sub total	15.684.824
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	579.600
Stores	181.000
Powder Magazine	45.000
Hoist Room	285.740
Crusher Room (U/G)	1.690.844
	0
Sub total	5.480.084
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	7.000.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	11.000.000
	0
Total Capital	32.164.908

R & P Shaft 5.000 tpd	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		647.173	0	0	0	0	0	0	0	647.173	0	0	0	0	0	0	0	0	647.173	0	
Drilling Jumbo's		779.191	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	0	0	0	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		80.167	0	0	0	0	80.167	0	0	0	0	0	80.167	0	0	0	0	0	80.167	0	
Pickup Trucks		325.590	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	325.590	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		5.891	0	0	0	5.891	0	0	0	0	5.891	0	0	0	0	5.891	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		9.383	0	0	0	0	9.383	0	0	0	0	0	9.383	0	0	0	0	0	9.383	0	
Sub total	**0**	**4.057.720**	**1.962.294**	**0**	**2.045.778**	**356.881**	**2.469.273**	**0**	**2.045.778**	**1.148.082**	**2.319.175**	**0**	**2.552.757**	**0**	**1.962.294**	**356.881**	**83.485**	**0**	**1.655.061**	**0**	**0**
Buildings																					
Workshop		615.400																			
Changehouse		3.319.800																			
Office		901.600																			
Stores		289.600																			
Powder Magazine		90.000																			
Hoist Room		450.590																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**7.357.834**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	11.300.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**15.300.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**15.300.000**	**11.415.554**	**1.962.294**	**0**	**2.045.778**	**356.881**	**2.469.273**	**0**	**2.045.778**	**1.148.082**	**2.319.175**	**0**	**2.552.757**	**0**	**1.962.294**	**356.881**	**83.485**	**0**	**1.655.061**	**0**	**0**

R & P Shaft 5.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.344.019
Rear-dump Trucks	1.941.520
Drilling Jumbo's	6.233.525
Drills	439.018
Feeders	351.749
Bulldozers	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	320.668
Pickup Trucks	976.771
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	23.564
Caplamp Charger Unit	28.131
Self Rescuers	37.532
	0
Sub total	23.015.458
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	901.600
Stores	289.600
Powder Magazine	90.000
Hoist Room	450.590
Crusher Room (U/G)	1.690.844
	0
Sub total	7.357.834
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	11.300.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	15.300.000
	0
Total Capital	45.673.292

R & P Shaft 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	506.919	0	0	0	0	0	0	0	0	506.919	0	
Drilling Jumbo's		1.168.786	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	0	0	0	0	
Drills		82.316	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		116.180	0	0	0	0	53.445	0	0	0	0	0	53.445	0	0	0	0	0	53.445	0	
Pickup Trucks		434.121	0	0	0	0	0	0	0	325.590	0	0	0	0	0	0	0	0	325.590	0	
Primary Fan		183.611	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	149.134	0	0	0	0	0	149.134	0	0	0	0	0	149.134	0	
Secondary Fans		77.009	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		9.160	0	0	0	4.789	0	0	0	0	4.789	0	0	0	0	4.789	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		14.589	0	0	0	0	7.628	0	0	0	0	0	7.628	0	0	0	0	0	7.628	0	
Sub total	**0**	**6.705.081**	**1.558.947**	**0**	**1.642.431**	**355.779**	**2.010.702**	**0**	**1.642.431**	**1.007.827**	**1.914.726**	**0**	**2.094.187**	**0**	**1.558.947**	**355.779**	**83.485**	**0**	**1.459.583**	**0**	**0**
Buildings																					
Workshop		579.200																			
Changehouse		4.941.975																			
Office		1.288.000																			
Stores		271.500																			
Powder Magazine		90.000																			
Hoist Room		879.200																			
Crusher Room (U/G)		3.272.601																			
Sub total	**0**	**11.322.476**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	28.200.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**32.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**32.200.000**	**18.027.557**	**1.558.947**	**0**	**1.642.431**	**355.779**	**2.010.702**	**0**	**1.642.431**	**1.007.827**	**1.914.726**	**0**	**2.094.187**	**0**	**1.558.947**	**355.779**	**83.485**	**0**	**1.459.583**	**0**	**0**

R & P Shaft 14.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.812.646
Rear-dump Trucks	2.955.359
Drilling Jumbo's	3.895.953
Drills	466.457
Feeders	351.749
Bulldozers	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	276.514
Pickup Trucks	1.085.301
Primary Fan	597.695
Primary Fan Motor	623.281
Secondary Fans	269.531
U/G Crusher	1.192.162
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	23.527
Caplamp Charger Unit	35.164
Self Rescuers	37.473
	0
Sub total	22.389.905
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	1.288.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	879.200
Crusher Room (U/G)	3.272.601
	0
Sub total	11.322.476
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	28.200.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	32.200.000
	0
Total Capital	65.912.381

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix E4

Disclaimer

May 2010

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	mton	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
width	meter	12,0	12,0	14,0	14,0	14,0	14,0	14,0	14,0
height	meter	8,0	8,0	8,0	8,0	8,0	8,0	8,0	8,0
cross-sectional area	m2	96,0	96,0	112,0	112,0	112,0	112,0	112,0	112,0
Rock density	tonne/m3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Daily Advance	meter	6	6	8	8	17	17	47	47
Depth of pull	meter	3	3	3	3	4	4	6	6
No. Faces	No.	2	2	3	3	4	4	8	8
Blast size	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Pulls per day	No.	2	2	3	3	4	4	8	8
Total Resource:									
Blast size:	tonnes	763	763	890	890	1.187	1.187	1.781	1.781
Powder factor:	kg/tonne	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Drill factor:	m/tonne								
Number of holes	No.	64	64,00	75	75	56	56	75	75
Reamer holes	No.	5	5	5	5	5	5	5	5
Total Number of holes	No.	69	69	80	80	61	61	80	80
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Primary Openings	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0042	UA0032	UA0042	UA0033	UA0042	UA0034	UA0042	UA0035
Ventilation Shafts	no	1	1	1	1	1	1	1	1
Sinking Code	type	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0
Equipment									
Hydraulic Shovels	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0129	EU0129	EU0130	EU0130	EU0130	EU0130	EU0131	EU0131
Rear-dump Trucks	no	2	2	2	2	2	2	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Drilling Jumbo's	no	1	1	1	1	2	2	3	3
	type	EU0093	EU0093	EU0094	EU0094	EU0094	EU0094	EU0094	EU0094
Drills	no	1	1	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083	EU0083
Bulldozers	no								
	type								
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	1	1
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	1	1
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	2	2	2	2	3	3	4	4
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	3	3	3	4	4
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	no	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	no	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	no	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	no	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	no	1	1	1	1	1	1	1	1
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	no	31	23	42	35	50	43	75	66
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	no	1	1	1	1	1	1	2	2
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	no	31	23	42	35	50	43	75	66
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Room & Pillar		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Buildings									
Workshop	m2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	500	500	900	900	1.400	1.400	2.000	2.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	no	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	1.576	1.707	2.857	2.494	3.554	3.876	6.423	7.771
Electricity (Incl. Hoisting)	kWh/day	11.868	16.993	23.278	33.074	40.118	66.187	46.713	133.514
Hoisting:	kWh/day	0	3.008	0	5.344	0	14.520	0	46.000
Explosives	kg/face	649	649	757	757	757	757	1.514	1.514
Powder	kg/day	1.275	1.275	2.125	2.125	3.188	3.188	11.900	11.900
Caps	#/face	64	64	75	75	56	56	75	75
Caps	#/day	126	126	210	210	236	236	587	587
Primers	#/face	64	64	75	75	56	56	75	75
Primers	#/day	126	126	210	210	236	236	587	587
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	600	600	900	900	1.200	1.200	2.400	2.400
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	no	2	2	2	2	4	4	6	6
Blasters	no			2	2	2	2	2	2
Excavator Operators	no	2	2	4	4	4	4	4	4
Truck Drivers	no	4	4	4	4	4	4	12	12
Equipment Operators	no	2	2	3	3	4	4	6	6
Utility Operators	no	1	1	1	1	1	1	1	1
Mechanics	no	13	6	17	11	19	12	26	18
Laborers/Maintenance	no	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	no	1	1	1	1	1	1	1	1
Superintendent	no							1	1
Foreman	no	1	1	1	1	2	2	2	2
Engineer	no			1	1	1	1	1	1
Geologist	no								
Supervisor	no								
Technician	no								
Accountant	no								
Clerk	no								
Personnel	no								
Secretary	no								
Security	no								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		28	21	38	32	46	39	68	60

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Hydraulic Shovels	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	366.220	521.501	521.501	755.815	366.220	1.043.002	1.043.002	1.511.630	3	3	2	2
	type	EU0129	EU0130	EU0130	EU0131												
Rear-dump Trucks	n°	2	2	2	6	183.666	278.282	344.514	331.713	367.333	556.565	689.027	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Drilling Jumbo's	n°	1	1	2	3	330.599	389.595	389.595	389.595	330.599	389.595	779.191	1.168.786	3	3	2	2
	type	EU0093	EU0094	EU0094	EU0094												
Drills	n°	1	2	2	3	27.439	27.439	27.439	27.439	27.439	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	21.984	21.984	43.969	43.969	43.969	43.969	3	3	2	2
	type	EU0083	EU0083	EU0083	EU0083												
Bulldozers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Graders	n°	1	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	133.576	133.576	4	4	3	3
	type	EU0114	EU0114	EU0114	EU0114												
Scalers	n°	1	1	1	1	205.929	205.929	205.929	205.929	205.929	205.929	205.929	205.929	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	1	175.318	175.318	175.318	175.318	175.318	175.318	175.318	175.318	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	2	2	3	4	16.308	26.722	26.722	29.045	32.617	53.445	80.167	116.180	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	3	3	4	15.027	15.027	15.027	15.027	45.082	45.082	45.082	60.109	11	11	9	9
	type	E0224	E0224	E0224	E0224												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	1650	1650	1650	1650	1.300.222	1.300.222	1.610.863	2.001.718	1.300.222	1.300.222	1.610.863	2.001.718	7	7	6	6
	type	BU0476	BU0476	BU0484	BU0490												
Caplamps	n°	31	42	50	75	138	138	138	138	4.269	5.781	6.947	10.326	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	1	1	2	7.033	7.033	7.033	7.033	7.033	7.033	7.033	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	31	42	50	75	220	220	220	220	6.800	9.208	11.065	16.447	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										3.533.192	**4.663.299**	**5.566.242**	**8.518.142**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Room & Pillar Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m^2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m^2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m^2	500	900	1.400	2.000	644	644	644	644	322.000	579.600	901.600	1.288.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m^2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m^2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m^2	0	0	0	0	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
Crusher Room (U/G)	n^o	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**3.667.202**	**5.194.344**	**6.907.244**	**10.443.276**				
Working Capital																	
25% of OPEX										680.553	970.417	1.429.577	1.980.351				
									Sub Total:	**680.553**	**970.417**	**1.429.577**	**1.980.351**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1.500	1.500	1.500	1.500	6.500	6.500	6.500	6.500	9.750.000	9.750.000	9.750.000	9.750.000	20	20	20	20
Sinking Code	type	UA0042	UA0042	UA0042	UA0042												
Mob. / Demob.						0	0	0	0	0	0	0	0				
Sink Costs						0	0	0	0	0	0	0	0				
Ventilation Shafts	no	1	1	1	1	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	20	20	20	20
Sinking Code	type	UA0036	UA0036	UA0036	UA0036												
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
										13.750.000	**13.750.000**	**13.750.000**	**13.750.000**				

Total Capital: Incl. Equipment	**21.630.946**	**24.578.060**	**27.653.063**	**34.691.769**	**GB£**

OPEX		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
Room & Pillar Adit Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Hydraulic Shovels	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	20,16	28,28	28,28	39,37	9.110	25.573	31.967	37.556	3.495	9.958	12.447	17.180	66.946	187.810	234.762	326.783
	type	EU0129	EU0130	EU0130	EU0131									419	1.135	1.419	1.702				
Rear-dump Trucks	nº	2	2	2	6	4,78	8,02	8,99	9,39	10.385	21.693	27.116	96.039	994	1.205	1.863	5.383	31.708	53.253	74.651	233.931
	type	E0249	E0258	E0259	E0260									443	1.008	1.243	3.781				
Drilling Jumbo's	nº	1	1	2	3	7,41	8,70	8,70	8,70	628	628	1.571	2.356	1.436	1.691	4.228	6.342	24.594	28.881	72.203	108.304
	type	EU0093	EU0094	EU0094	EU0094									0	0	0	0				
Drills	nº	1	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	166	331	414	621	10.699	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	nº	2	2	2	2	0,57	0,57	0,57	0,57	0	0	0	0	266	266	333	333	3.806	3.806	4.758	4.758
	type	EU0083	EU0083	EU0083	EU0083									0	0	0	0				
Bulldozers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Graders	nº	1	1	1	1	4,33	4,33	4,33	4,33	1.035	1.035	1.293	1.293	562	562	702	702	14.376	14.376	17.970	17.970
	type	EU0114	EU0114	EU0114	EU0114									233	233	291	291				
Scalers	nº	1	1	1	1	5,89	5,89	5,89	5,89	1.257	1.257	1.571	1.571	910	910	1.137	1.137	19.568	19.568	24.460	24.460
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	300				
Rockbolters	nº	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	nº	1	1	1	1	5,01	5,01	5,01	5,01	1.257	1.257	1.571	1.571	775	775	969	969	16.649	16.649	20.811	20.811
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	160				
Misc.	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Pumps	nº	2	2	3	4	0,59	0,96	0,96	1,05	0	0	0	0	3	4	8	12	3.917	6.356	11.918	17.369
	type	B0075	B0076	B0076	B0077									2.971	3.961	7.427	12.379				
Pickup Trucks	nº	3	3	3	4	0,57	0,57	0,57	0,57	277	277	346	462	10.046	10.046	12.558	16.744	2.752	2.752	3.440	4.586
	type	E0224	E0224	E0224	E0224									113	113	142	189				
Primary Fan	nº	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	nº	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	nº	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	nº	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	nº	1	1	1	1	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	1650	1650	1650	1650	21,12	21,12	26,17	32,52	0	0	0	0	4.936	4.936	7.644	9.499	70.124	70.124	108.604	134.958
	type	BU0476	BU0476	BU0484	BU0490									1.485	1.485	4.951	8.665				
Caplamps	nº	31	42	50	75	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	nº	1	1	1	2	0,14	0,14	0,14	0,14	0	0	0	0	38	38	47	94	480	480	601	1.201
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	nº	31	42	50	75	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	572	774	1.163	1.728
	type	EU0344	EU0344	EU0344	EU0344																
										24.576	52.348	66.220	141.633				Sub Total:	352.204	527.883	734.197	1.143.625

OPEX		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
Room & Pillar Adit Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	500	900	1400	2000	6,44	6,44	6,44	6,44									3.220,00	5.796,00	9.016,00	12.880,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	0	0	0	0	0,00	0,00	0,00	0,00									0,00	0,00	0,00	0,00
	type	0	0	0	0																
Crusher Room (U/G)	n^o	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**28.218**	**43.489**	**60.618**	**88.070**
Consumables																					
Diesel Fuel	liter/day	1.576	2.857	3.554	6.423	0,76	0,76	0,76	0,76					1.576	2.857	3.554	6.423	299.534	542.840	675.303	1.220.406
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	11.868	23.278	40.118	46.713	0,08	0,08	0,08	0,08					19.780	38.796	66.863	77.855	231.422	453.915	782.296	910.898
	type	C0002	C0002	C0002	C0002									**11.868**	**23.278**	**40.118**	**46.713**				
Explosives	kg/day	1.297	1.297	2.271	2.271	0,50	0,50	0,50	0,50									162.180	162.180	283.815	283.815
	type	C0003	C0003	C0003	C0003																
Caps	#/day	126	126	210	210	1,50	1,50	1,50	1,50									47.170	47.170	78.616	78.616
	type	C0004	C0004	C0004	C0004																
Primers	#/day	126	126	210	210	2,30	2,30	2,30	2,30									72.327	72.327	120.545	120.545
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	600	600	900	900	0,25	0,25	0,25	0,25									37.500	37.500	56.250	56.250
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	24.576	52.348	66.220	141.633									24.576	52.348	66.220	141.633
																	Sub Total:	**966.923**	**1.460.495**	**2.215.146**	**2.964.265**
Personal Hourly Rate																					
Drillers	n^o	2	2	4	2	12,50	12,50	12,50	12,50									100.000	100.000	250.000	125.000
Blasters	n^o	0	2	2	2	12,50	12,50	12,50	12,50									0	100.000	125.000	125.000
Excavator Operators	n^o	2	4	4	4	10,63	10,63	10,63	10,63									85.000	170.000	212.500	212.500
Truck Drivers	n^o	4	4	4	12	10,63	10,63	10,63	10,63									170.000	170.000	212.500	637.500
Equipment Operators	n^o	2	3	4	6	10,00	10,00	10,00	10,00									80.000	120.000	200.000	300.000
Utility Operators	n^o	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n^o	13	17	19	26	12,50	12,50	12,50	12,50					26.235	34.152	46.894	65.028	655.867	853.803	1.172.346	1.625.695
Laborers/Maintenance	n^o	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n^o	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n^o	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n^o	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n^o	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Geologist	n^o	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Supervisor	n^o	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n^o	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n^o	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n^o	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n^o	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n^o	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n^o	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**1.374.867**	**1.849.803**	**2.708.346**	**3.725.445**

Total Operational: Incl. Equipment	**2.722.211**	**3.881.670**	**5.718.307**	**7.921.404**	**GB£**

R & P Adit 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		366.220	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	0	366.220	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Drilling Jumbo's		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		27.439	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	0	27.439	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		32.617	0	0	0	0	0	32.617	0	0	0	0	0	0	32.617	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		4.269	0	0	0	0	0	4.269	0	0	0	0	0	0	4.269	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		6.800	0	0	0	0	0	6.800	0	0	0	0	0	0	6.800	0	0	0	0	0	
Sub total	**0**	**3.533.192**	**0**	**787.479**	**133.576**	**83.485**	**787.479**	**1.940.921**	**133.576**	**787.479**	**83.485**	**587.732**	**921.054**	**0**	**1.940.921**	**870.963**	**133.576**	**0**	**787.479**	**0**	**0**
Buildings																					
Workshop		236.024																			
Changehouse		1.279.632																			
Office		322.000																			
Stores		116.202																			
Powder Magazine		22.500																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**3.667.202**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.750.000**	**7.200.394**	**0**	**787.479**	**133.576**	**83.485**	**787.479**	**1.940.921**	**133.576**	**787.479**	**83.485**	**587.732**	**921.054**	**0**	**1.940.921**	**870.963**	**133.576**	**0**	**787.479**	**0**	**0**

R & P Adit 1.500 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	2.563.537
Rear-dump Trucks	734.665
Drilling Jumbo's	2.314.196
Drills	192.070
Feeders	307.780
Bulldozers	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	97.851
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	12.807
Caplamp Charger Unit	21.098
Self Rescuers	20.399
	0
Sub total	13.512.394
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	322.000
Stores	116.202
Powder Magazine	22.500
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	3.667.202
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	13.750.000
	0
Total Capital	30.929.595

R & P Adit 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	0	1.043.002	0	
Rear-dump Trucks		556.565	0	0	0	0	0	0	0	0	0	556.565	0	0	0	0	0	0	0	0	
Drilling Jumbo's		389.595	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	0	389.595	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		53.445	0	0	0	0	0	53.445	0	0	0	0	0	0	53.445	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		5.781	0	0	0	0	0	5.781	0	0	0	0	0	0	5.781	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		9.208	0	0	0	0	0	9.208	0	0	0	0	0	0	9.208	0	0	0	0	0	
Sub total	**0**	**4.663.299**	**0**	**1.558.947**	**133.576**	**83.485**	**1.558.947**	**2.110.328**	**133.576**	**1.558.947**	**83.485**	**776.964**	**1.692.522**	**0**	**2.110.328**	**1.642.431**	**133.576**	**0**	**1.558.947**	**0**	**0**
Buildings																					
Workshop		434.400																			
Changehouse		2.263.500																			
Office		579.600																			
Stores		181.000																			
Powder Magazine		45.000																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**5.194.344**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.750.000**	**9.857.643**	**0**	**1.558.947**	**133.576**	**83.485**	**1.558.947**	**2.110.328**	**133.576**	**1.558.947**	**83.485**	**776.964**	**1.692.522**	**0**	**2.110.328**	**1.642.431**	**133.576**	**0**	**1.558.947**	**0**	**0**

R & P Adit 2.500 tpd	**GB£**
Hydraulic Shovels	0
Front-end Loaders	7.301.016
Rear-dump Trucks	1.113.130
Drilling Jumbo's	2.727.167
Drills	384.141
Feeders	307.780
Bulldozers	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	160.334
Pickup Trucks	90.163
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	17.343
Caplamp Charger Unit	21.098
Self Rescuers	27.624
	0
Sub total	19.799.356
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	579.600
Stores	181.000
Powder Magazine	45.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	5.194.344
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	13.750.000
	0
Total Capital	38.743.700

R & P Adit 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.043.002	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		689.027	0	0	0	0	0	0	0	689.027	0	0	0	0	0	0	0	0	689.027	0	
Drilling Jumbo's		779.191	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	779.191	0	0	0	0	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		80.167	0	0	0	0	80.167	0	0	0	0	0	80.167	0	0	0	0	0	80.167	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.610.863	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	
Caplamps		6.947	0	0	0	6.947	0	0	0	0	6.947	0	0	0	0	6.947	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		11.065	0	0	0	0	11.065	0	0	0	0	0	11.065	0	0	0	0	0	11.065	0	
Sub total	**0**	**5.566.242**	**1.962.294**	**133.576**	**2.045.778**	**357.937**	**4.215.394**	**0**	**2.045.778**	**1.043.002**	**2.320.231**	**0**	**4.298.878**	**0**	**1.962.294**	**491.513**	**83.485**	**0**	**3.162.527**	**0**	**0**
Buildings																					
Workshop		615.400																			
Changehouse		3.319.800																			
Office		901.600																			
Stores		289.600																			
Powder Magazine		90.000																			
Hoist Room		0																			
Crusher Room (U/G)		1.690.844																			
Sub total	**0**	**6.907.244**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.750.000**	**12.473.486**	**1.962.294**	**133.576**	**2.045.778**	**357.937**	**4.215.394**	**0**	**2.045.778**	**1.043.002**	**2.320.231**	**0**	**4.298.878**	**0**	**1.962.294**	**491.513**	**83.485**	**0**	**3.162.527**	**0**	**0**

R & P Adit 5.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.344.019
Rear-dump Trucks	2.067.081
Drilling Jumbo's	6.233.525
Drills	439.018
Feeders	351.749
Bulldozers	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	320.668
Pickup Trucks	135.245
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	6.443.451
Caplamps	27.790
Caplamp Charger Unit	28.131
Self Rescuers	44.262
	0
Sub total	29.688.928
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	901.600
Stores	289.600
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	6.907.244
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	13.750.000
	0
Total Capital	50.346.172

R & P Adit 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	1.043.002	0	0	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	556.565	0	0	0	0	0	0	0	0	556.565	0	
Drilling Jumbo's		1.168.786	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	389.595	0	0	0	0	0	
Drills		82.316	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	0	0	0	0	
Feeders		43.969	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	43.969	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		116.180	0	0	0	0	53.445	0	0	0	0	0	53.445	0	0	0	0	0	53.445	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		183.611	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	149.134	0	0	0	0	0	149.134	0	0	0	0	0	149.134	0	
Secondary Fans		77.009	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	27.503	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		2.001.718	0	0	0	0	1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	1.300.222	0	
Caplamps		10.326	0	0	0	5.781	0	0	0	0	5.781	0	0	0	0	5.781	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	7.033	0	0	0	0	
Self Rescuers		16.447	0	0	0	0	9.208	0	0	0	0	0	9.208	0	0	0	0	0	9.208	0	
Sub total	**0**	**8.518.142**	**1.558.947**	**133.576**	**1.642.431**	**356.771**	**3.446.079**	**0**	**1.642.431**	**910.540**	**1.915.718**	**0**	**3.529.564**	**0**	**1.558.947**	**490.346**	**83.485**	**0**	**2.664.097**	**0**	**0**
Buildings																					
Workshop		579.200																			
Changehouse		4.941.975																			
Office		1.288.000																			
Stores		271.500																			
Powder Magazine		90.000																			
Hoist Room		0																			
Crusher Room (U/G)		3.272.601																			
Sub total	**0**	**10.443.276**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development																					
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.750.000**	**18.961.418**	**1.558.947**	**133.576**	**1.642.431**	**356.771**	**3.446.079**	**0**	**1.642.431**	**910.540**	**1.915.718**	**0**	**3.529.564**	**0**	**1.558.947**	**490.346**	**83.485**	**0**	**2.664.097**	**0**	**0**

R & P Adit 14.000 tpd	
	GB£
Hydraulic Shovels	0
Front-end Loaders	8.812.646
Rear-dump Trucks	3.103.405
Drilling Jumbo's	3.895.953
Drills	466.457
Feeders	351.749
Bulldozers	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	276.514
Pickup Trucks	150.272
Primary Fan	597.695
Primary Fan Motor	623.281
Secondary Fans	269.531
U/G Crusher	1.192.162
U/G Crusher Motor	0
Feeder	0
Conveyor	5.902.383
Caplamps	27.670
Caplamp Charger Unit	35.164
Self Rescuers	44.070
	0
Sub total	28.451.074
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	1.288.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	3.272.601
	0
Sub total	10.443.276
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	0
Sub total	13.750.000
	0
Total Capital	52.644.350

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix F1

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	Mt	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
In situ Density	tonne/m^3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Development									
Main level Face Width	meter	14	14	14	14	15	15	15	15
Main level Face Height	meter	5	5	5	5	5	5	5	5
Main level Depth of Pull	meter	3	3	3	3	4	4	5	5
Sub-level Face Width	meter	5	5	5	5	5	5	5	5
Sub-level Face Height	meter	5	5	5	5	5	5	5	5
Sub-level Face Depth of Pu	meter	3	3	3	3	4	4	5	5
Level Spacing	meter	10	10	10	10	15	15	15	15
Ring Design									
Burden:	m	2,7	2,7	2,7	2,7	3,3	3,3	3,3	3,3
Spacing:	m	3,6	3,6	3,6	3,6	4,3	4,3	4,3	4,3
Number of holes	No.	8	8	8	8	8	8	8	8
Hole Length per ring	m	81	81	81	81	107	107	107	107
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Sub level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Sub Level Developm.	tonnes	143.776	155.171	211.448	222.843	274.495	285.890	536.577	547.972
Production Level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Mainlevel Developm.	tonnes	402.573	434.479	592.055	623.961	823.484	857.669	1.609.732	1.643.917
Total Development	tonnes	546.349	589.650	803.503	846.804	1.097.978	1.143.558	2.146.309	2.191.889
Production									
Opening Slots	m3	7.151	7.151	11.918	11.918	23.155	23.155	64.833	64.833
Crusher Room	m3	31.500	31.500	31.500	31.500	31.500	31.500	31.500	31.500
Primary Openings	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0043	UA0038	UA0043	UA0039	UA0043	UA0040	UA0043	UA0041
Ventilation Shafts	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0

Longhole		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Equipment		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Development									
Drilling Jumbo's Sub level	no	1	1	2	2	3	3	3	3
	type	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090
Drilling Jumbo's Main level	no	1	1	1	1	2	2	2	2
	type	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093
Drills	no	2	2	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0084	EU0084	EU0084	EU0084
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	E0132	EU0130	E0132	EU0131	E0133	EU0131	E0134	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Production									
Drilling Jumbo's	no	1	1	1	1	1	1	2	2
	type	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095
Drills	no								
	type								
Feeders	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0130	EU0130	EU0131	EU0131	EU0131	EU0131	EU0131	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Misc.									
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	2	2
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	2	2
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	4	4	4	4	6	6	8	8
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	1	3	1	4	2
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	n°	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	n°	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	n°	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	n°	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	n°	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	n°	45	50	71	81	87	96	116	125
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	n°	1	1	2	2	2	2	2	3
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	n°	45	50	71	81	87	96	116	125
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Buildings		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Workshop	m^2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m^2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m^2	1.047	1.047	1.800	1.800	2.700	2.700	4.000	4.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m^2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m^2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m^2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	n°	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	2.605	3.229	6.984	6.380	9.476	11.009	13.044	15.080
Electricity (Incl. Hoisting)	kWh/day	13.654	27.776	25.660	30.112	44.584	56.133	54.155	94.956
Hoisting:	kWh/day	1.485	3.008	1.485	5.344	4.951	14.520	8.665	46.000
Explosives	kg/face	0	0	0	0	0	0	0	0
Powder	kg/day	2.518	2.518	2.687	2.687	7.178	7.178	10.241	10.241
Caps	#/face	8	8	8	8	8	8	8	8
Caps	#/day	202	202	204	204	230	230	248	248
Primers	#/face	8	8	8	8	8	8	8	8
Primers	#/day	202	202	204	204	230	230	248	248
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	n°	6	6	8	8	12	12	14	14
Blasters	n°	3	3	4	4	8	8	16	16
Excavator Operators	n°	4	4	8	8	8	8	8	8
Truck Drivers	n°	8	8	16	16	16	16	24	24
Equipment Operators	n°	2	2	2	2	2	2	2	2
Utility Operators	n°	1	1	1	1	1	1	1	1
Mechanics	n°	13	18	21	29	24	32	30	38
Laborers/Maintenance	n°	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	n°	1	1	1	1	1	1	1	1
Superintendent	n°							1	1
Foreman	n°	1	1	1	1	2	2	2	2
Engineer	n°			1	1	1	1	1	1
Geologist	n°								
Supervisor	n°								
Technician	n°								
Accountant	n°								
Clerk	n°								
Personnel	n°								
Secretary	n°								
Security	n°								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		41	46	65	73	79	87	106	114

CAPEX Longhole Shaft Access		Item				Item Price				Total Costs				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Equipment		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Drilling Jumbo's Sub level	n°	1	2	3	3	386.813	386.813	386.813	386.813	386.813	773.625	1.160.438	1.160.438	3	3	2	2
	type	EU0090	EU0090	EU0090	EU0090												
Drilling Jumbo's Main leve	n°	1	1	2	2	330.599	330.599	330.599	330.599	330.599	330.599	661.199	661.199	3	3	2	2
	type	EU0093	EU0093	EU0093	EU0093												
Drills	n°	2	2	2	3	27.439	27.439	27.439	27.439	54.877	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	24.711	24.711	43.969	43.969	49.423	49.423	3	3	2	2
	type	EU0083	EU0083	EU0084	EU0084												
Front-end Loaders	n°	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	n°	2	4	4	6	220.177	253.460	323.587	323.587	440.354	1.013.838	1.294.347	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Production		0	0	0	0												
Drilling Jumbo's	n°	1	1	1	2	140.811	140.811	140.811	140.811	140.811	140.811	140.811	281.622	7	7	6	6
	type	EU0095	EU0095	EU0095	EU0095												
Drills	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	n°	2	4	4	6	220.177	253.460	323.587	323.587	440.354	1.013.838	1.294.347	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Misc.			0	0	0												
Graders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Scalers	n°	1	1	1	2	205.929	205.929	205.929	205.929	205.929	205.929	205.929	411.858	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	2	175.318	175.318	175.318	175.318	175.318	175.318	175.318	350.636	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	4	4	6	8	16.308	26.722	26.722	29.045	65.234	106.889	160.334	232.359	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	1	1	2	15.027	108.530	108.530	108.530	45.082	108.530	108.530	217.060	11	11	9	9
	type	E0224	EU0429	EU0429	EU0429												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	0	0	0	0					0	0	0	0	0	0	0	0
	type	0	0	0	0												
Caplamps	n°	50	81	96	125	138	138	138	138	6.935	11.135	13.247	17.277	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	2	2	3	7.033	7.033	7.033	7.033	7.033	14.066	14.066	21.098	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	50	81	96	125	220	220	220	220	11.046	17.735	21.100	27.518	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										3.884.144	**7.674.118**	**9.057.421**	**11.406.602**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Shaft Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Workshop	m2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	1.047	1.800	2.700	4.000	644	644	644	644	674.268	1.159.200	1.738.800	2.576.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m2	185	260	410	800	1.099	1.099	1.099	1.099	203.315	285.740	450.590	879.200				
	type	B0084	B0084	B0084	B0084												
Crusher Room (U/G)	no	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**4.222.785**	**6.059.684**	**8.195.034**	**12.610.476**				
Working Capital																	
25% of OPEX										1.146.082	1.790.303	2.714.098	3.519.601				
									Sub Total:	**1.146.082**	**1.790.303**	**2.714.098**	**3.519.601**				
Engineering & Managemen																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1	1	1	1	6.900.000	8.600.000	12.900.000	29.900.000	6.900.000	8.600.000	12.900.000	29.900.000	20	20	20	20
Sinking Code	type	UA0038	UA0039	UA0040	UA0041												
Mob. / Demob.																	
Sink Costs																	
Ventilation Shafts	no	1	1	1	1	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	20	20	20	20
Sinking Code	type	UA0037	UA0037	UA0037	UA0037												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0					0	0	0	0				
										0	0	0	0				
Total Sub Level Developr	tonnes	155.171	222.843	285.890	547.972					0	0	0	0				
Total Mainlevel Developn	tonnes	434.479	623.961	857.669	1.643.917					0	0	0	0				
Total Development	tonnes	589.650	846.804	1.143.558	2.191.889	7,00	7,00	7,00	7,00	4.127.547	5.927.630	8.004.908	15.343.223				
										16.327.547	**19.827.630**	**26.204.908**	**50.543.223**				

Total Capital: Incl. Equipment	**25.580.558**	**35.351.735**	**46.171.461**	**78.079.902**	**GB£**

Opex		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Development																					
Drilling Jumbo's Sub level	n°	1	2	3	3	8,49	8,49	8,49	8,49	266	531	996	996	1.680	3.361	6.302	6.302	28.197	56.395	105.740	105.740
	type	EU0090	EU0090	EU0090	EU0090									0	0	0	0				
Drilling Jumbo's Main level	n°	1	1	2	2	7,41	7,41	7,41	7,41	1.129	1.129	2.822	2.822	1.436	1.436	3.589	3.589	24.594	24.594	61.485	61.485
	type	EU0093	EU0093	EU0093	EU0093									0	0	0	0				
Drills	n°	2	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	331	331	414	621	21.397	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	n°	2	2	2	2	0,57	0,57	0,63	0,63	0	0	0	0	266	266	375	375	3.806	3.806	5.266	5.266
	type	EU0083	EU0083	EU0084	EU0084									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	28,28	39,37	39,37	39,37	22.974	53.983	67.479	67.479	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	n°	2	4	4	6	7,52	8,84	12,18	12,18	17.928	46.746	96.446	144.669	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Production																					
Drilling Jumbo's	n°	1	1	1	2	7,06	7,06	7,06	7,06	0	0	0	0	611	611	764	1.527	23.449	23.449	29.311	58.621
	type	EU0095	EU0095	EU0095	EU0095									0	0	0	0				
Drills	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeders	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	28,28	39,37	39,37	39,37	12.787	30.045	37.556	37.556	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	n°	2	4	4	6	7,52	8,84	12,18	12,18	9.978	26.017	53.678	80.518	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Misc.																					
Graders	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Scalers	n°	1	1	1	2	5,89	5,89	5,89	5,89	1.257	1.257	1.571	3.141	910	910	1.137	2.275	19.568	19.568	24.460	48.920
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	600				
Rockbolters	n°	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	n°	1	1	1	2	5,01	5,01	5,01	5,01	1.257	1.257	1.571	3.141	775	775	969	1.938	16.649	16.649	20.811	41.622
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	319				
Misc.	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0	0	0	0	0
Pumps	n°	4	4	6	8	0,59	0,96	0,96	1,05	0	0	0	0	5	9	17	24	7.835	12.713	23.837	34.739
	type	B0075	B0076	B0076	B0077									5.942	7.922	14.854	24.757				
Pickup Trucks	n°	3	1	1	2	0,57	3,29	3,29	3,29	277	1.257	1.571	3.141	4.842	1.681	2.101	4.202	5.710	10.920	13.651	27.301
	type	E0224	EU0429	EU0429	EU0429									113	62	77	154				
Primary Fan	n°	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	n°	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	n°	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	n°	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	no	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Caplamps	n°	50	81	96	125	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	n°	1	2	2	3	0,14	0,14	0,14	0,14	0	0	0	0	38	75	94	141	480	961	1.201	1.802
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	n°	50	81	96	125	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	928	1.491	2.217	2.891
	type	EU0344	EU0344	EU0344	EU0344																
										68.480	**162.849**	**264.475**	**344.249**				**Sub Total:**	**526.366**	**1.051.342**	**1.504.883**	**1.895.442**

Opex		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**liter / day**	**liter / day**	**liter / day**	**liter / day**	**1.500**	**2.500**	**5.000**	**14.000**
Buildings						GB£/day	GB£/day	GB£/day	GB£/day												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	1047	1800	2700	4000	6,44	6,44	6,44	6,44									6.742,68	11.592,00	17.388,00	25.760,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	185	260	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084	GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**33.774**	**52.143**	**73.496**	**109.742**
Consumables																					
Diesel Fuel	liter/day	3.229	6.380	11.009	15.080	0,76	0,76	0,76	0,76					3.229	6.380	11.009	15.080	613.536	1.212.129	2.091.767	2.865.179
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	27.776	30.112	56.133	94.956	0,08	0,08	0,08	0,08					21.271	41.281	69.355	81.593	541.642	587.194	1.094.599	1.851.632
	type	C0002	C0002	C0002	C0002									**12.762**	**24.768**	**41.613**	**48.956**				
Explosives	kg/day	2.518	2.518	2.687	2.687	0,50	0,50	0,50	0,50									314.801	314.801	335.855	335.855
	type	C0003	C0003	C0003	C0003																
Caps	#/day	202	202	204	204	1,50	1,50	1,50	1,50									75.750	75.750	76.500	76.500
	type	C0004	C0004	C0004	C0004																
Primers	#/day	202	202	204	204	2,30	2,30	2,30	2,30									116.150	116.150	117.300	117.300
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	1.500	1.500	1.500	1.500	0,25	0,25	0,25	0,25									93.750	93.750	93.750	93.750
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	68.480	162.849	264.475	344.249									68.480	162.849	264.475	344.249
																	Sub Total:	**1.916.323**	**2.654.836**	**4.226.347**	**5.836.566**
Personal Hourly Rate																					
Drillers	n°	6	8	12	8	12,50	12,50	12,50	12,50									300.000	400.000	750.000	500.000
Blasters	n°	3	4	8	16	12,50	12,50	12,50	12,50									150.000	200.000	500.000	1.000.000
Excavator Operators	n°	4	8	8	8	10,63	10,63	10,63	10,63									170.000	340.000	425.000	425.000
Truck Drivers	n°	8	16	16	24	10,63	10,63	10,63	10,63									340.000	680.000	850.000	1.275.000
Equipment Operators	n°	2	2	2	2	10,00	10,00	10,00	10,00									80.000	80.000	100.000	100.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	16	27	30	36	12,50	12,50	12,50	12,50					27.355	50.676	70.627	84.476	783.864	1.366.889	1.890.667	2.236.905
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**2.107.864**	**3.402.889**	**5.051.667**	**6.236.655**

Total Operational: Incl. Equipment	**4.584.327**	**7.161.210**	**10.856.393**	**14.078.405**	**GB£**

Longhole Shaft 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		386.813	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		65.234	0	0	0	0	0	65.234	0	0	0	0	0	0	65.234	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		6.935	0	0	0	0	0	6.935	0	0	0	0	0	0	6.935	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		11.046	0	0	0	0	0	11.046	0	0	0	0	0	0	11.046	0	0	0	0	0	
Sub total	**0**	**3.884.144**	**0**	**1.878.512**	**0**	**83.485**	**1.878.512**	**554.477**	**0**	**1.878.512**	**83.485**	**1.101.108**	**1.878.512**	**0**	**554.477**	**1.961.997**	**0**	**0**	**1.878.512**	**0**	**0**
Buildings																					
Workshop	236.024																				
Changehouse	1.279.632																				
Office	674.268																				
Stores	116.202																				
Powder Magazine	22.500																				
Hoist Room	203.315																				
Crusher Room (U/G)	1.690.844																				
Sub total	**4.222.785**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	6.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development	4.127.547																				
Sub total	**12.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**16.422.785**	**3.884.144**	**0**	**1.878.512**	**0**	**83.485**	**1.878.512**	**554.477**	**0**	**1.878.512**	**83.485**	**1.101.108**	**1.878.512**	**0**	**554.477**	**1.961.997**	**0**	**0**	**1.878.512**	**0**	**0**

Longhole Shaft 1.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	2.707.688
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	3.650.508
Rear-dump Trucks	880.708
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	3.650.508
Rear-dump Trucks	880.708
Equuipment, Misc.	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	195.702
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	20.806
Caplamp Charger Unit	21.098
Self Rescuers	33.138
	0
	0
Sub total	17.615.734
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	674.268
Stores	116.202
Powder Magazine	22.500
Hoist Room	203.315
Crusher Room (U/G)	1.690.844
	0
Sub total	4.222.785
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	6.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	4.127.547
Sub total	12.200.000
	0
Total Capital	34.038.519

Longhole Shaft 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		773.625	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.013.838	0	0	0	0	0	0	0	0	0	1.013.838	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.013.838	0	0	0	0	0	0	0	0	0	1.013.838	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		106.889	0	0	0	0	0	106.889	0	0	0	0	0	0	106.889	0	0	0	0	0	
Pickup Trucks		108.530	0	0	0	0	0	0	0	0	0	108.530	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		11.135	0	0	0	0	0	11.135	0	0	0	0	0	0	11.135	0	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	0	0	14.066	0	0	0	0	0	0	14.066	0	0	0	0	0	
Self Rescuers		17.735	0	0	0	0	0	17.735	0	0	0	0	0	0	17.735	0	0	0	0	0	
Sub total	**0**	**7.674.118**	**0**	**4.253.833**	**0**	**83.485**	**4.253.833**	**740.791**	**0**	**4.253.833**	**83.485**	**2.311.525**	**4.253.833**	**0**	**740.791**	**4.337.318**	**0**	**0**	**4.253.833**	**0**	**0**
Buildings																					
Workshop	434.400																				
Changehouse	2.263.500																				
Office	1.159.200																				
Stores	181.000																				
Powder Magazine	45.000																				
Hoist Room	285.740																				
Crusher Room (U/G)	1.690.844																				
Sub total	**6.059.684**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	8.600.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development	5.927.630																				
Sub total	**13.900.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**19.959.684**	**7.674.118**	**0**	**4.253.833**	**0**	**83.485**	**4.253.833**	**740.791**	**0**	**4.253.833**	**83.485**	**2.311.525**	**4.253.833**	**0**	**740.791**	**4.337.318**	**0**	**0**	**4.253.833**	**0**	**0**

Longhole Shaft 2.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	5.415.375
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	10.581.409
Rear-dump Trucks	2.027.677
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	10.581.409
Rear-dump Trucks	2.027.677
Equuipment, Misc.	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	320.668
Pickup Trucks	217.060
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	33.405
Caplamp Charger Unit	42.197
Self Rescuers	53.205
	0
	0
Sub total	37.240.679
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	1.159.200
Stores	181.000
Powder Magazine	45.000
Hoist Room	285.740
Crusher Room (U/G)	1.690.844
	0
Sub total	6.059.684
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	8.600.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	5.927.630
Sub total	13.900.000
	0
Total Capital	57.200.363

Longhole Shaft 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	
Rear-dump Trucks		1.294.347	0	0	0	0	0	0	0	1.294.347	0	0	0	0	0	0	0	0	1.294.347	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	140.811	0	0	0	0	0	140.811	0	0	0	0	0	140.811	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.294.347	0	0	0	0	0	0	0	1.294.347	0	0	0	0	0	0	0	0	1.294.347	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		160.334	0	0	0	0	160.334	0	0	0	0	0	160.334	0	0	0	0	0	160.334	0	
Pickup Trucks		108.530	0	0	0	0	0	0	0	108.530	0	0	0	0	0	0	0	0	108.530	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		13.247	0	0	0	13.247	0	0	0	0	13.247	0	0	0	0	13.247	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		21.100	0	0	0	0	21.100	0	0	0	0	0	21.100	0	0	0	0	0	21.100	0	
Sub total	**0**	**9.057.421**	**4.949.196**	**0**	**5.073.936**	**343.957**	**5.467.476**	**0**	**5.073.936**	**2.872.542**	**5.334.408**	**0**	**5.550.961**	**0**	**4.990.451**	**343.957**	**3.521.051**	**0**	**5.275.504**	**0**	**0**
Buildings																					
Workshop	615.400																				
Changehouse	3.319.800																				
Office	1.738.800																				
Stores	289.600																				
Powder Magazine	90.000																				
Hoist Room	450.590																				
Crusher Room (U/G)	1.690.844																				
Sub total	8.195.034	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	12.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development	8.004.908																				
Sub total	**18.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**26.395.034**	**9.057.421**	**4.949.196**	**0**	**5.073.936**	**343.957**	**5.467.476**	**0**	**5.073.936**	**2.872.542**	**5.334.408**	**0**	**5.550.961**	**0**	**4.990.451**	**343.957**	**3.521.051**	**0**	**5.275.504**	**0**	**0**

Longhole Shaft 5.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	548.773
Feeders	494.229
Front-end Loaders	13.604.669
Rear-dump Trucks	3.883.041
Equipment, Production	0
Drilling Jumbo's	563.244
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	3.883.041
Equuipment, Misc.	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	641.336
Pickup Trucks	325.590
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	52.989
Caplamp Charger Unit	56.262
Self Rescuers	84.398
	0
	0
Sub total	57.854.797
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	1.738.800
Stores	289.600
Powder Magazine	90.000
Hoist Room	450.590
Crusher Room (U/G)	1.690.844
	0
Sub total	8.195.034
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	12.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	8.004.908
Sub total	18.200.000
	0
Total Capital	84.249.831

Longhole Shaft 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		82.316	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	1.941.520	0	0	0	0	0	0	0	0	1.941.520	0	
Equipment, Production																					
Drilling Jumbo's		281.622	0	0	0	0	281.622	0	0	0	0	0	281.622	0	0	0	0	0	281.622	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	1.941.520	0	0	0	0	0	0	0	0	1.941.520	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		411.858	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		350.636	0	0	0	0	0	0	0	350.636	0	0	0	0	0	0	0	0	350.636	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		232.359	0	0	0	0	232.359	0	0	0	0	0	232.359	0	0	0	0	0	232.359	0	
Pickup Trucks		217.060	0	0	0	0	0	0	0	217.060	0	0	0	0	0	0	0	0	217.060	0	
Primary Fan		183.611	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		77.009	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	467.514	0	0	0	0	0	467.514	0	0	0	0	0	467.514	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		17.277	0	0	0	17.277	0	0	0	0	17.277	0	0	0	0	17.277	0	0	0	0	
Caplamp Charger Unit		21.098	0	0	0	21.098	0	0	0	0	21.098	0	0	0	0	21.098	0	0	0	0	
Self Rescuers		27.518	0	0	0	0	27.518	0	0	0	0	0	27.518	0	0	0	0	0	27.518	0	
Sub total	**0**	**11.406.602**	**4.976.635**	**0**	**5.137.129**	**595.469**	**5.743.505**	**0**	**5.137.129**	**4.450.737**	**5.649.113**	**0**	**5.826.990**	**0**	**5.053.644**	**595.469**	**3.548.490**	**0**	**7.093.973**	**0**	**0**
Buildings																					
Workshop	579.200																				
Changehouse	4.941.975																				
Office	2.576.000																				
Stores	271.500																				
Powder Magazine	90.000																				
Hoist Room	879.200																				
Crusher Room (U/G)	3.272.601																				
Sub total	**12.610.476**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	29.900.000																				
Ventilation Shaft	5.300.000																				
U/G Services Infra	0																				
U/G Development	15.343.223																				
Sub total	**35.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**47.810.476**	**11.406.602**	**4.976.635**	**0**	**5.137.129**	**595.469**	**5.743.505**	**0**	**5.137.129**	**4.450.737**	**5.649.113**	**0**	**5.826.990**	**0**	**5.053.644**	**595.469**	**3.548.490**	**0**	**7.093.973**	**0**	**0**

Longhole Shaft 14.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	823.159
Feeders	494.229
Front-end Loaders	13.604.669
Rear-dump Trucks	5.824.561
Equipment, Production	0
Drilling Jumbo's	1.126.487
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	5.824.561
Equuipment, Misc.	0
Graders	0
Scalers	1.647.432
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	1.051.907
Misc.	0
Pumps	929.436
Pickup Trucks	651.181
Primary Fan	734.443
Primary Fan Motor	703.520
Secondary Fans	616.072
U/G Crusher	1.870.058
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	69.108
Caplamp Charger Unit	84.393
Self Rescuers	110.071
	0
	0
Sub total	65.214.883
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	2.576.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	879.200
Crusher Room (U/G)	3.272.601
	0
Sub total	12.610.476
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	29.900.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	15.343.223
Sub total	35.200.000
	0
Total Capital	113.025.359

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix F2

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	Mt	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
In situ Density	tonne/m^3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Development									
Main level Face Width	meter	14	14	14	14	15	15	15	15
Main level Face Height	meter	5	5	5	5	5	5	5	5
Main level Depth of Pull	meter	3	3	3	3	4	4	5	5
Sub-level Face Width	meter	5	5	5	5	5	5	5	5
Sub-level Face Height	meter	5	5	5	5	5	5	5	5
Sub-level Face Depth of Pu	meter	3	3	3	3	4	4	5	5
Level Spacing	meter	10	10	10	10	15	15	15	15
Ring Design									
Burden:	m	2,7	2,7	2,7	2,7	3,3	3,3	3,3	3,3
Spacing:	m	3,6	3,6	3,6	3,6	4,3	4,3	4,3	4,3
Number of holes	No.	8	8	8	8	8	8	8	8
Hole Length per ring	m	81	81	81	81	107	107	107	107
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Sub level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Sub Level Developm.	tonnes	143.776	155.171	211.448	222.843	274.495	285.890	536.577	547.972
Production Level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Mainlevel Developm.	tonnes	402.573	434.479	592.055	623.961	823.484	857.669	1.609.732	1.643.917
Total Development	tonnes	546.349	589.650	803.503	846.804	1.097.978	1.143.558	2.146.309	2.191.889
Production									
Opening Slots	m3	7.151	7.151	11.918	11.918	23.155	23.155	64.833	64.833
Crusher Room	m3	31.500	31.500	31.500	31.500	31.500	31.500	31.500	31.500
Primary Openings	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0043	UA0038	UA0043	UA0039	UA0043	UA0040	UA0043	UA0041
Ventilation Shafts	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037	UA0037
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Equipment		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Development									
Drilling Jumbo's Sub level	no	1	1	2	2	3	3	3	3
	type	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090
Drilling Jumbo's Main level	no	1	1	1	1	2	2	2	2
	type	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093
Drills	no	2	2	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0084	EU0084	EU0084	EU0084
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	E0132	EU0130	E0132	EU0131	E0133	EU0131	E0134	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Production									
Drilling Jumbo's	no	1	1	1	1	1	1	2	2
	type	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095
Drills	no								
	type								
Feeders	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0130	EU0130	EU0131	EU0131	EU0131	EU0131	EU0131	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Misc.									
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	2	2
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	2	2
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	4	4	4	4	6	6	8	8
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	1	3	1	4	2
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	n°	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	n°	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	n°	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	n°	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	n°	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	n°	45	50	71	81	87	96	116	125
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	n°	1	1	2	2	2	2	2	3
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	n°	45	50	71	81	87	96	116	125
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Buildings		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Workshop	m^2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m^2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m^2	1.047	1.047	1.800	1.800	2.700	2.700	4.000	4.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m^2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m^2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m^2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	n^o	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	2.605	3.229	6.984	6.380	9.476	11.009	13.044	15.080
Electricity (Incl. Hoisting)	kWh/day	13.654	27.776	25.660	30.112	44.584	56.133	54.155	94.956
Hoisting:	kWh/day	1.485	3.008	1.485	5.344	4.951	14.520	8.665	46.000
Explosives	kg/face	0	0	0	0	0	0	0	0
Powder	kg/day	2.518	2.518	2.687	2.687	7.178	7.178	10.241	10.241
Caps	#/face	8	8	8	8	8	8	8	8
Caps	#/day	202	202	204	204	230	230	248	248
Primers	#/face	8	8	8	8	8	8	8	8
Primers	#/day	202	202	204	204	230	230	248	248
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	n^o	6	6	8	8	12	12	14	14
Blasters	n^o	3	3	4	4	8	8	16	16
Excavator Operators	n^o	4	4	8	8	8	8	8	8
Truck Drivers	n^o	8	8	16	16	16	16	24	24
Equipment Operators	n^o	2	2	2	2	2	2	2	2
Utility Operators	n^o	1	1	1	1	1	1	1	1
Mechanics	n^o	13	18	21	29	24	32	30	38
Laborers/Maintenance	n^o	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	n^o	1	1	1	1	1	1	1	1
Superintendent	n^o							1	1
Foreman	n^o	1	1	1	1	2	2	2	2
Engineer	n^o			1	1	1	1	1	1
Geologist	n^o								
Supervisor	n^o								
Technician	n^o								
Accountant	n^o								
Clerk	n^o								
Personnel	n^o								
Secretary	n^o								
Security	n^o								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		41	46	65	73	79	87	106	114

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Equipment		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Drilling Jumbo's Sub level	n°	1	2	3	3	386.813	386.813	386.813	386.813	386.813	773.625	1.160.438	1.160.438	3	3	2	2
	type	EU0090	EU0090	EU0090	EU0090												
Drilling Jumbo's Main level	n°	1	1	2	2	330.599	330.599	330.599	330.599	330.599	330.599	661.199	661.199	3	3	2	2
	type	EU0093	EU0093	EU0093	EU0093												
Drills	n°	2	2	2	3	27.439	27.439	27.439	27.439	54.877	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	24.711	24.711	43.969	43.969	49.423	49.423	3	3	2	2
	type	EU0083	EU0083	EU0084	EU0084												
Front-end Loaders	n°	1	2	2	2	206.779	206.779	432.618	773.625	206.779	413.558	865.236	1.547.250	3	3	4	4
	type	E0132	E0132	E0133	E0134												
Rear-dump Trucks	n°	2	4	4	6	183.666	278.282	344.514	331.713	367.333	1.113.130	1.378.054	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Production		0	0	0	0												
Drilling Jumbo's	n°	1	1	1	2	140.811	140.811	140.811	140.811	140.811	140.811	140.811	281.622	7	7	6	6
	type	EU0095	EU0095	EU0095	EU0095												
Drills	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	n°	2	4	4	6	183.666	278.282	344.514	331.713	367.333	1.113.130	1.378.054	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Misc.			0	0	0												
Graders	n°	1	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	133.576	133.576	4	4	3	3
	type	EU0114	EU0114	EU0114	EU0114												
Scalers	n°	1	1	1	2	205.929	205.929	205.929	205.929	205.929	205.929	205.929	411.858	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	2	175.318	175.318	175.318	175.318	175.318	175.318	175.318	350.636	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	4	4	6	8	16.308	26.722	26.722	29.045	65.234	106.889	160.334	232.359	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	3	3	4	15.027	15.027	15.027	15.027	45.082	45.082	45.082	60.109	11	11	9	9
	type	E0224	E0224	E0224	E0224												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	1650	1650	1650	1650	1.300.222	1.300.222	1.610.863	2.001.718	1.300.222	1.300.222	1.610.863	2.001.718	7	7	6	6
	type	BU0476	BU0476	BU0484	BU0490												
Caplamps	n°	45	71	87	116	138	138	138	138	6.265	9.859	12.030	16.056	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	2	2	2	7.033	7.033	7.033	7.033	7.033	14.066	14.066	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	45	71	87	116	220	220	220	220	9.979	15.704	19.161	25.572	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										4.855.439	**8.141.670**	**10.256.275**	**13.507.876**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	1.047	1.800	2.700	4.000	644	644	644	644	674.268	1.159.200	1.738.800	2.576.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m2	0	0	0	0	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
Crusher Room (U/G)	no	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**4.019.470**	**5.773.944**	**7.744.444**	**11.731.276**				
Working Capital																	
25% of OPEX										1.012.915	1.694.844	2.599.669	3.381.113				
									Sub Total:	**1.012.915**	**1.694.844**	**2.599.669**	**3.381.113**				
Engineering & Managemen																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1.500	1.500	1.500	1.500	8.970	8.970	8.970	8.970	13.455.000	13.455.000	13.455.000	13.455.000	20	20	20	20
Sinking Code	type	UA0043	UA0043	UA0043	UA0043												
Mob. / Demob.						0	0	0	0	0	0	0	0				
Sink Costs						0	0	0	0	0	0	0	0				
Ventilation Shafts	no	1	1	1	1	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	5.300.000	20	20	20	20
Sinking Code	type	UA0037	UA0037	UA0037	UA0037												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0					0	0	0	0				
										0	0	0	0				
Total Sub Level Developr	tonnes	143.776	211.448	274.495	536.577					0	0	0	0				
Total Mainlevel Developn	tonnes	402.573	592.055	823.484	1.609.732					0	0	0	0				
Total Development	tonnes	546.349	803.503	1.097.978	2.146.309	7,00	7,00	7,00	7,00	3.824.440	5.624.523	7.685.848	15.024.163				
										22.579.440	**24.379.523**	**26.440.848**	**33.779.163**				

Total Capital: Incl. Equipment	**32.467.264**	**39.989.980**	**47.041.235**	**62.399.428**	**GB£**

Opex		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Development																					
Drilling Jumbo's Sub level	nº	1	2	3	3	8,49	8,49	8,49	8,49	266	531	996	996	1.680	3.361	6.302	6.302	28.197	56.395	105.740	105.740
	type	EU0090	EU0090	EU0090	EU0090									0	0	0	0				
Drilling Jumbo's Main level	nº	1	1	2	2	7,41	7,41	7,41	7,41	1.129	1.129	2.822	2.822	1.436	1.436	3.589	3.589	24.594	24.594	61.485	61.485
	type	EU0093	EU0093	EU0093	EU0093									0	0	0	0				
Drills	nº	2	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	331	331	414	621	21.397	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	nº	2	2	2	2	0,57	0,57	0,63	0,63	0	0	0	0	266	266	375	375	3.806	3.806	5.266	5.266
	type	EU0083	EU0083	EU0084	EU0084									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	28,28	39,37	39,37	39,37	22.974	53.983	67.479	67.479	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	nº	2	4	4	6	7,52	8,84	12,18	12,18	17.928	46.746	96.446	144.669	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Production																					
Drilling Jumbo's	nº	1	1	1	2	7,06	7,06	7,06	7,06	0	0	0	0	611	611	764	1.527	23.449	23.449	29.311	58.621
	type	EU0095	EU0095	EU0095	EU0095									0	0	0	0				
Drills	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeders	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	nº	1	2	2	2	28,28	39,37	39,37	39,37	12.787	30.045	37.556	37.556	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	nº	2	4	4	6	7,52	8,84	12,18	12,18	9.978	26.017	53.678	80.518	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Misc.																					
Graders	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Scalers	nº	1	1	1	2	5,89	5,89	5,89	5,89	1.257	1.257	1.571	3.141	910	910	1.137	2.275	19.568	19.568	24.460	48.920
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	600				
Rockbolters	nº	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	nº	1	1	1	2	5,01	5,01	5,01	5,01	1.257	1.257	1.571	3.141	775	775	969	1.938	16.649	16.649	20.811	41.622
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	319				
Misc.	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0	0	0	0	0
Pumps	nº	4	4	6	8	0,59	0,96	0,96	1,05	0	0	0	0	5	9	17	24	7.835	12.713	23.837	34.739
	type	B0075	B0076	B0076	B0077									5.942	7.922	14.854	24.757				
Pickup Trucks	nº	3	1	1	2	0,57	3,29	3,29	3,29	277	1.257	1.571	3.141	4.842	1.681	2.101	4.202	5.710	10.920	13.651	27.301
	type	E0224	EU0429	EU0429	EU0429									113	62	77	154				
Primary Fan	nº	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	nº	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	nº	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	nº	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	no	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	nº	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Caplamps	nº	50	81	96	125	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	nº	1	2	2	3	0,14	0,14	0,14	0,14	0	0	0	0	38	75	94	141	480	961	1.201	1.802
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	nº	50	81	96	125	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	928	1.491	2.217	2.891
	type	EU0344	EU0344	EU0344	EU0344																
										68.480	**162.849**	**264.475**	**344.249**				**Sub Total:**	**526.366**	**1.051.342**	**1.504.883**	**1.895.442**

Opex		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/day	GB£/day	GB£/day	GB£/day												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	1047	1800	2700	4000	6,44	6,44	6,44	6,44									6.742,68	11.592,00	17.388,00	25.760,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	185	260	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084	GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**33.774**	**52.143**	**73.496**	**109.742**
Consumables																					
Diesel Fuel	liter/day	3.229	6.380	11.009	15.080	0,76	0,76	0,76	0,76					3.229	6.380	11.009	15.080	613.536	1.212.129	2.091.767	2.865.179
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	27.776	30.112	56.133	94.956	0,08	0,08	0,08	0,08					21.271	41.281	69.355	81.593	541.642	587.194	1.094.599	1.851.632
	type	C0002	C0002	C0002	C0002									**12.762**	**24.768**	**41.613**	**48.956**				
Explosives	kg/day	2.518	2.518	2.687	2.687	0,50	0,50	0,50	0,50									314.801	314.801	335.855	335.855
	type	C0003	C0003	C0003	C0003																
Caps	#/day	202	202	204	204	1,50	1,50	1,50	1,50									75.750	75.750	76.500	76.500
	type	C0004	C0004	C0004	C0004																
Primers	#/day	202	202	204	204	2,30	2,30	2,30	2,30									116.150	116.150	117.300	117.300
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	1.500	1.500	1.500	1.500	0,25	0,25	0,25	0,25									93.750	93.750	93.750	93.750
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	68.480	162.849	264.475	344.249									68.480	162.849	264.475	344.249
																	Sub Total:	**1.916.323**	**2.654.836**	**4.226.347**	**5.836.566**
Personal Hourly Rate																					
Drillers	n°	6	8	12	8	12,50	12,50	12,50	12,50									300.000	400.000	750.000	500.000
Blasters	n°	3	4	8	16	12,50	12,50	12,50	12,50									150.000	200.000	500.000	1.000.000
Excavator Operators	n°	4	8	8	8	10,63	10,63	10,63	10,63									170.000	340.000	425.000	425.000
Truck Drivers	n°	8	16	16	24	10,63	10,63	10,63	10,63									340.000	680.000	850.000	1.275.000
Equipment Operators	n°	2	2	2	2	10,00	10,00	10,00	10,00									80.000	80.000	100.000	100.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	16	27	30	36	12,50	12,50	12,50	12,50					27.355	50.676	70.627	84.476	783.864	1.366.889	1.890.667	2.236.905
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**2.107.864**	**3.402.889**	**5.051.667**	**6.236.655**

Total Operational:	**4.584.327**	**7.161.210**	**10.856.393**	**14.078.405**	**GB£**
Incl. Equipment					

Longhole Adit 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		386.813	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		206.779	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		65.234	0	0	0	0	0	65.234	0	0	0	0	0	0	65.234	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		6.265	0	0	0	0	0	6.265	0	0	0	0	0	0	6.265	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		9.979	0	0	0	0	0	9.979	0	0	0	0	0	0	9.979	0	0	0	0	0	
Sub total	**0**	**4.855.439**	**0**	**1.563.790**	**133.576**	**83.485**	**1.563.790**	**554.477**	**133.576**	**1.563.790**	**83.485**	**955.065**	**1.697.366**	**0**	**554.477**	**1.647.275**	**133.576**	**0**	**1.563.790**	**0**	**0**
Buildings																					
Workshop	236.024																				
Changehouse	1.279.632																				
Office	674.268																				
Stores	116.202																				
Powder Magazine	22.500																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**4.019.470**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development	3.824.440																				
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**22.774.470**	**4.855.439**	**0**	**1.563.790**	**133.576**	**83.485**	**1.563.790**	**554.477**	**133.576**	**1.563.790**	**83.485**	**955.065**	**1.697.366**	**0**	**554.477**	**1.647.275**	**133.576**	**0**	**1.563.790**	**0**	**0**

Longhole Adit 1.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	2.707.688
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	1.447.452
Rear-dump Trucks	734.665
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	3.650.508
Rear-dump Trucks	734.665
Equuipment, Misc.	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	195.702
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	18.795
Caplamp Charger Unit	21.098
Self Rescuers	29.936
	0
	0
Sub total	17.086.954
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	674.268
Stores	116.202
Powder Magazine	22.500
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	4.019.470
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	3.824.440
Sub total	18.755.000
	0
Total Capital	39.861.424

Longhole Adit 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		773.625	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		413.558	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	
Rear-dump Trucks		1.113.130	0	0	0	0	0	0	0	0	0	1.113.130	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.113.130	0	0	0	0	0	0	0	0	0	1.113.130	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		106.889	0	0	0	0	0	106.889	0	0	0	0	0	0	106.889	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		9.859	0	0	0	0	0	9.859	0	0	0	0	0	0	9.859	0	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	0	0	14.066	0	0	0	0	0	0	14.066	0	0	0	0	0	
Self Rescuers		15.704	0	0	0	0	0	15.704	0	0	0	0	0	0	15.704	0	0	0	0	0	
Sub total	**0**	**8.141.670**	**0**	**3.155.761**	**133.576**	**83.485**	**3.155.761**	**740.791**	**133.576**	**3.155.761**	**83.485**	**2.446.659**	**3.289.337**	**0**	**740.791**	**3.239.246**	**133.576**	**0**	**3.155.761**	**0**	**0**
Buildings																					
Workshop	434.400																				
Changehouse	2.263.500																				
Office	1.159.200																				
Stores	181.000																				
Powder Magazine	45.000																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**5.773.944**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development	5.624.523																				
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**24.528.944**	**8.141.670**	**0**	**3.155.761**	**133.576**	**83.485**	**3.155.761**	**740.791**	**133.576**	**3.155.761**	**83.485**	**2.446.659**	**3.289.337**	**0**	**740.791**	**3.239.246**	**133.576**	**0**	**3.155.761**	**0**	**0**

Longhole Adit 2.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	5.415.375
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	2.894.904
Rear-dump Trucks	2.226.259
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	10.581.409
Rear-dump Trucks	2.226.259
Equuipment, Misc.	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	320.668
Pickup Trucks	90.163
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	29.578
Caplamp Charger Unit	42.197
Self Rescuers	47.111
	0
	0
Sub total	31.789.234
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	1.159.200
Stores	181.000
Powder Magazine	45.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	5.773.944
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	5.624.523
Sub total	18.755.000
	0
Total Capital	56.318.177

Longhole Adit 5.000 tpd	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		865.236	0	0	865.236	0	0	0	865.236	0	0	0	865.236	0	0	0	865.236	0	0	0	
Rear-dump Trucks		1.378.054	0	0	0	0	0	0	0	1.378.054	0	0	0	0	0	0	0	0	1.378.054	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	140.811	0	0	0	0	0	140.811	0	0	0	0	0	140.811	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.378.054	0	0	0	0	0	0	0	1.378.054	0	0	0	0	0	0	0	0	1.378.054	0	
Equuipment, Misc.																					
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		160.334	0	0	0	0	160.334	0	0	0	0	0	160.334	0	0	0	0	0	160.334	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.610.863	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	
Caplamps		12.030	0	0	0	12.030	0	0	0	0	12.030	0	0	0	0	12.030	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		19.161	0	0	0	0	19.161	0	0	0	0	0	19.161	0	0	0	0	0	19.161	0	
Sub total	**0**	**10.256.275**	**3.437.567**	**133.576**	**4.427.542**	**343.957**	**4.089.422**	**0**	**4.427.542**	**3.110.084**	**3.822.778**	**0**	**5.038.142**	**0**	**3.478.821**	**477.533**	**2.874.657**	**0**	**5.513.045**	**0**	**0**
Buildings																					
Workshop	615.400																				
Changehouse	3.319.800																				
Office	1.738.800																				
Stores	289.600																				
Powder Magazine	90.000																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**7.744.444**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development	7.685.848																				
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**26.499.444**	**10.256.275**	**3.437.567**	**133.576**	**4.427.542**	**343.957**	**4.089.422**	**0**	**4.427.542**	**3.110.084**	**3.822.778**	**0**	**5.038.142**	**0**	**3.478.821**	**477.533**	**2.874.657**	**0**	**5.513.045**	**0**	**0**

Longhole Adit 5.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	548.773
Feeders	494.229
Front-end Loaders	4.326.178
Rear-dump Trucks	4.134.163
Equipment, Production	0
Drilling Jumbo's	563.244
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	4.134.163
Equuipment, Misc.	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	641.336
Pickup Trucks	135.245
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	6.443.451
Caplamps	48.120
Caplamp Charger Unit	56.262
Self Rescuers	76.642
	0
	0
Sub total	51.430.940
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	1.738.800
Stores	289.600
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	7.744.444
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	7.685.848
Sub total	18.755.000
	0
Total Capital	77.930.383

Longhole Adit 14.000 tpd		CAPEX																			
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		82.316	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.547.250	0	0	1.547.250	0	0	0	1.547.250	0	0	0	1.547.250	0	0	0	1.547.250	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	1.990.276	0	0	0	0	0	0	0	0	1.990.276	0	
Equipment, Production																					
Drilling Jumbo's		281.622	0	0	0	0	281.622	0	0	0	0	0	281.622	0	0	0	0	0	281.622	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	1.990.276	0	0	0	0	0	0	0	0	1.990.276	0	
Equuipment, Misc.																					
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		411.858	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		350.636	0	0	0	0	0	0	0	350.636	0	0	0	0	0	0	0	0	350.636	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		232.359	0	0	0	0	232.359	0	0	0	0	0	232.359	0	0	0	0	0	232.359	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	60.109	0	0	0	0	0	0	0	0	60.109	0	
Primary Fan		183.611	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		77.009	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	467.514	0	0	0	0	0	467.514	0	0	0	0	0	467.514	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		2.001.718	0	0	0	0	2.001.718	0	0	0	0	0	2.001.718	0	0	0	0	0	2.001.718	0	
Caplamps		16.056	0	0	0	16.056	0	0	0	0	16.056	0	0	0	0	16.056	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		25.572	0	0	0	0	25.572	0	0	0	0	0	25.572	0	0	0	0	0	25.572	0	
Sub total	**0**	**13.507.876**	**3.465.005**	**133.576**	**5.172.749**	**595.469**	**4.365.451**	**0**	**5.172.749**	**4.524.871**	**4.137.483**	**0**	**5.996.185**	**0**	**3.542.014**	**729.044**	**3.584.110**	**0**	**7.168.108**	**0**	**0**
Buildings																					
Workshop	579.200																				
Changehouse	4.941.975																				
Office	2.576.000																				
Stores	271.500																				
Powder Magazine	90.000																				
Hoist Room	0																				
Crusher Room (U/G)	3.272.601																				
Sub total	**11.731.276**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	13.455.000																				
Ventilation Adit	5.300.000																				
U/G Services Infra	0																				
U/G Development	15.024.163																				
Sub total	**18.755.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**30.486.276**	**13.507.876**	**3.465.005**	**133.576**	**5.172.749**	**595.469**	**4.365.451**	**0**	**5.172.749**	**4.524.871**	**4.137.483**	**0**	**5.996.185**	**0**	**3.542.014**	**729.044**	**3.584.110**	**0**	**7.168.108**	**0**	**0**

Longhole Adit 14.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	823.159
Feeders	494.229
Front-end Loaders	7.736.250
Rear-dump Trucks	5.970.827
Equipment, Production	0
Drilling Jumbo's	1.126.487
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	5.970.827
Equuipment, Misc.	0
Graders	935.029
Scalers	1.647.432
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	1.051.907
Misc.	0
Pumps	929.436
Pickup Trucks	180.327
Primary Fan	734.443
Primary Fan Motor	703.520
Secondary Fans	616.072
U/G Crusher	1.870.058
U/G Crusher Motor	0
Feeder	0
Conveyor	8.006.873
Caplamps	64.223
Caplamp Charger Unit	56.262
Self Rescuers	102.290
	0
	0
Sub total	62.094.689
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	2.576.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	3.272.601
	0
Sub total	11.731.276
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	13.455.000
Ventilation Shaft	5.300.000
U/G Services Infra	0
U/G Development	15.024.163
Sub total	18.755.000
	0
Total Capital	92.580.965

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix F3

Disclaimer
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May 2010

Longhole		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	Mt	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
In situ Density	tonne/m^3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Development									
Main level Face Width	meter	14	14	14	14	15	15	15	15
Main level Face Height	meter	5	5	5	5	5	5	5	5
Main level Depth of Pull	meter	3	3	3	3	4	4	5	5
Sub-level Face Width	meter	5	5	5	5	5	5	5	5
Sub-level Face Height	meter	5	5	5	5	5	5	5	5
Sub-level Face Depth of Pu	meter	3	3	3	3	4	4	5	5
Level Spacing	meter	10	10	10	10	15	15	15	15
Ring Design									
Burden:	m	2,7	2,7	2,7	2,7	3,3	3,3	3,3	3,3
Spacing:	m	3,6	3,6	3,6	3,6	4,3	4,3	4,3	4,3
Number of holes	No.	8	8	8	8	8	8	8	8
Hole Length per ring	m	81	81	81	81	107	107	107	107
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Sub level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Sub Level Developm.	tonnes	143.776	155.171	211.448	222.843	274.495	285.890	536.577	547.972
Production Level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Mainlevel Developm.	tonnes	402.573	434.479	592.055	623.961	823.484	857.669	1.609.732	1.643.917
Total Development	tonnes	546.349	589.650	803.503	846.804	1.097.978	1.143.558	2.146.309	2.191.889
Production									
Opening Slots	m3	7.151	7.151	11.918	11.918	23.155	23.155	64.833	64.833
Crusher Room	m3	31.500	31.500	31.500	31.500	31.500	31.500	31.500	31.500
Primary Openings	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0042	UA0032	UA0042	UA0033	UA0042	UA0034	UA0042	UA0035
Ventilation Shafts	n°	1	1	1	1	1	1	1	1
Sinking Code	type	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0

Longhole		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Equipment		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Development									
Drilling Jumbo's Sub level	no	1	1	2	2	3	3	3	3
	type	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090
Drilling Jumbo's Main level	no	1	1	1	1	2	2	2	2
	type	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093
Drills	no	2	2	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0084	EU0084	EU0084	EU0084
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	E0132	EU0130	E0132	EU0131	E0133	EU0131	E0134	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Production									
Drilling Jumbo's	no	1	1	1	1	1	1	2	2
	type	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095
Drills	no								
	type								
Feeders	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0130	EU0130	EU0131	EU0131	EU0131	EU0131	EU0131	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Misc.									
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	2	2
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	2	2
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	2	2	2	2	3	3	4	4
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	1	3	1	4	2
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	n°	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	n°	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	n°	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	n°	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	n°	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	n°	45	50	71	81	87	96	116	125
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	n°	1	1	2	2	2	2	2	3
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	n°	45	50	71	81	87	96	116	125
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Buildings		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Workshop	m^2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m^2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m^2	1.047	1.047	1.800	1.800	2.700	2.700	4.000	4.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m^2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m^2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m^2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	n^o	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	2.605	3.229	6.984	6.380	9.476	11.009	13.044	15.080
Electricity (Incl. Hoisting)	kWh/day	11.869	25.397	23.280	27.733	40.123	51.672	46.720	87.521
Hoisting:	kWh/day	1.485	3.008	1.485	5.344	4.951	14.520	8.665	46.000
Explosives	kg/face	0	0	0	0	0	0	0	0
Powder	kg/day	2.518	2.518	2.687	2.687	7.178	7.178	10.241	10.241
Caps	#/face	8	8	8	8	8	8	8	8
Caps	#/day	202	202	204	204	230	230	248	248
Primers	#/face	8	8	8	8	8	8	8	8
Primers	#/day	202	202	204	204	230	230	248	248
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	n^o	6	6	8	8	12	12	14	14
Blasters	n^o	3	3	4	4	8	8	16	16
Excavator Operators	n^o	4	4	8	8	8	8	8	8
Truck Drivers	n^o	8	8	16	16	16	16	24	24
Equipment Operators	n^o	2	2	2	2	2	2	2	2
Utility Operators	n^o	1	1	1	1	1	1	1	1
Mechanics	n^o	13	18	21	29	24	32	30	38
Laborers/Maintenance	n^o	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	n^o	1	1	1	1	1	1	1	1
Superintendent	n^o							1	1
Foreman	n^o	1	1	1	1	2	2	2	2
Engineer	n^o			1	1	1	1	1	1
Geologist	n^o								
Supervisor	n^o								
Technician	n^o								
Accountant	n^o								
Clerk	n^o								
Personnel	n^o								
Secretary	n^o								
Security	n^o								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		41	46	65	73	79	87	106	114

CAPEX Longhole Shaft Access		Item				Item Price				Total Costs				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Equipment		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Drilling Jumbo's Sub level	n°	1	2	3	3	386.813	386.813	386.813	386.813	386.813	773.625	1.160.438	1.160.438	3	3	2	2
	type	EU0090	EU0090	EU0090	EU0090												
Drilling Jumbo's Main level	n°	1	1	2	2	330.599	330.599	330.599	330.599	330.599	330.599	661.199	661.199	3	3	2	2
	type	EU0093	EU0093	EU0093	EU0093												
Drills	n°	2	2	2	3	27.439	27.439	27.439	27.439	54.877	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	n°	2	2	2	2	21.984	21.984	24.711	24.711	43.969	43.969	49.423	49.423	3	3	2	2
	type	EU0083	EU0083	EU0084	EU0084												
Front-end Loaders	n°	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	n°	2	4	4	6	220.177	253.460	323.587	323.587	440.354	1.013.838	1.294.347	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Production		0	0	0	0												
Drilling Jumbo's	n°	1	1	1	2	140.811	140.811	140.811	140.811	140.811	140.811	140.811	281.622	7	7	6	6
	type	EU0095	EU0095	EU0095	EU0095												
Drills	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	n°	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	n°	2	4	4	6	220.177	253.460	323.587	323.587	440.354	1.013.838	1.294.347	1.941.520	11	11	9	9
	type	EU0399	EU0400	EU0402	EU0402												
Misc.			0	0	0												
Graders	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Scalers	n°	1	1	1	2	205.929	205.929	205.929	205.929	205.929	205.929	205.929	411.858	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	n°	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	n°	1	1	1	2	175.318	175.318	175.318	175.318	175.318	175.318	175.318	350.636	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	n°	2	2	3	4	16.308	26.722	26.722	29.045	32.617	53.445	80.167	116.180	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	n°	3	1	1	2	15.027	108.530	108.530	108.530	45.082	108.530	108.530	217.060	11	11	9	9
	type	E0224	EU0429	EU0429	EU0429												
Primary Fan	n°	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	n°	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	n°	2	3	4	8	9796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	n°	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	n°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	0	0	0	0					0	0	0	0	0	0	0	0
	type	0	0	0	0												
Caplamps	n°	50	81	96	125	138	138	138	138	6.935	11.135	13.247	17.276	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	n°	1	2	2	3	7.033	7.033	7.033	7.033	7.033	14.066	14.066	21.098	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	n°	50	81	96	125	220	220	220	220	11.046	17.735	21.099	27.516	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										3.851.527	**7.620.673**	**8.977.253**	**11.290.421**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Shaft Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Workshop	m2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	1.047	1.800	2.700	4.000	644	644	644	644	674.268	1.159.200	1.738.800	2.576.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m2	185	260	410	800	1.099	1.099	1.099	1.099	203.315	285.740	450.590	879.200				
	type	B0084	B0084	B0084	B0084												
Crusher Room (U/G)	no	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**4.222.785**	**6.059.684**	**8.195.034**	**12.610.476**				
Working Capital																	
25% of OPEX										1.133.486	1.782.350	2.829.670	3.715.000				
									Sub Total:	**1.133.486**	**1.782.350**	**2.829.670**	**3.715.000**				
Engineering & Managemen																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1	1	1	1	5.200.000	7.000.000	11.300.000	28.200.000	5.200.000	7.000.000	11.300.000	28.200.000	20	20	20	20
Sinking Code	type	UA0032	UA0033	UA0034	UA0035												
Mob. / Demob.																	
Sink Costs																	
Ventilation Shafts	no	1	1	1	1	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	20	20	20	20
Sinking Code	type	UA0036	UA0036	UA0036	UA0036												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0					0	0	0	0				
										0	0	0	0				
Total Sub Level Developr	tonnes	155.171	222.843	285.890	547.972					0	0	0	0				
Total Mainlevel Developn	tonnes	434.479	623.961	857.669	1.643.917					0	0	0	0				
Total Development	tonnes	589.650	846.804	1.143.558	2.191.889	7,00	7,00	7,00	7,00	4.127.547	5.927.630	8.004.908	15.343.223				
										13.327.547	**16.927.630**	**23.304.908**	**47.543.223**				

Total Capital:	22.535.344	32.390.336	43.306.864	75.159.119	GB£
Incl. Equipment					

Opex		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Development																					
Drilling Jumbo's Sub level	n°	1	2	3	3	8,49	8,49	8,49	8,49	266	531	996	996	1.680	3.361	6.302	6.302	28.197	56.395	105.740	105.740
	type	EU0090	EU0090	EU0090	EU0090									0	0	0	0				
Drilling Jumbo's Main level	n°	1	1	2	2	7,41	7,41	7,41	7,41	1.129	1.129	2.822	2.822	1.436	1.436	3.589	3.589	24.594	24.594	61.485	61.485
	type	EU0093	EU0093	EU0093	EU0093									0	0	0	0				
Drills	n°	2	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	331	331	414	621	21.397	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	n°	2	2	2	2	0,57	0,57	0,63	0,63	0	0	0	0	266	266	375	375	3.806	3.806	5.266	5.266
	type	EU0083	EU0083	EU0084	EU0084									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	28,28	39,37	39,37	39,37	22.974	53.983	67.479	67.479	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	n°	2	4	4	6	7,52	8,84	12,18	12,18	17.928	46.746	96.446	144.669	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Production																					
Drilling Jumbo's	n°	1	1	1	2	7,06	7,06	7,06	7,06	0	0	0	0	611	611	764	1.527	23.449	23.449	29.311	58.621
	type	EU0095	EU0095	EU0095	EU0095									0	0	0	0				
Drills	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeders	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	28,28	39,37	39,37	39,37	12.787	30.045	37.556	37.556	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	n°	2	4	4	6	7,52	8,84	12,18	12,18	9.978	26.017	53.678	80.518	1.947	4.484	7.148	10.722	49.964	117.446	202.241	303.362
	type	EU0399	EU0400	EU0402	EU0402									807	1.613	3.534	5.301				
Misc.																					
Graders	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Scalers	n°	1	1	1	2	5,89	5,89	5,89	5,89	1.257	1.257	1.571	3.141	910	910	1.137	2.275	19.568	19.568	24.460	48.920
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	600				
Rockbolters	n°	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	n°	1	1	1	2	5,01	5,01	5,01	5,01	1.257	1.257	1.571	3.141	775	775	969	1.938	16.649	16.649	20.811	41.622
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	319				
Misc.	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0	0	0	0	0
Pumps	n°	2	2	3	4	0,59	0,96	0,96	1,05	0	0	0	0	3	4	8	12	3.917	6.356	11.918	17.369
	type	B0075	B0076	B0076	B0077									2.971	3.961	7.427	12.379				
Pickup Trucks	n°	3	1	1	2	0,57	3,29	3,29	3,29	277	1.257	1.571	3.141	4.842	1.681	2.101	4.202	5.710	10.920	13.651	27.301
	type	E0224	EU0429	EU0429	EU0429									113	62	77	154				
Primary Fan	n°	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	n°	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	n°	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	n°	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	no	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Caplamps	n°	50	81	96	125	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	n°	1	2	2	3	0,14	0,14	0,14	0,14	0	0	0	0	38	75	94	141	480	961	1.201	1.802
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	n°	50	81	96	125	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	928	1.491	2.217	2.891
	type	EU0344	EU0344	EU0344	EU0344																
										68.480	162.849	264.475	344.249				Sub Total:	522.449	1.044.986	1.492.964	1.878.073

Opex		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Longhole Shaft Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/day	GB£/day	GB£/day	GB£/day												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	1047	1800	2700	4000	6,44	6,44	6,44	6,44									6.742,68	11.592,00	17.388,00	25.760,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	185	260	410	800	10,99	10,99	10,99	10,99									2.033,15	2.857,40	4.505,90	8.792,00
	type	B0084	B0084	B0084	B0084	GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**33.774**	**52.143**	**73.496**	**109.742**
Consumables																					
Diesel Fuel	liter/day	3.229	6.380	11.009	15.080	0,76	0,76	0,76	0,76					3.229	6.380	11.009	15.080	613.536	1.212.129	2.091.767	2.865.179
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	25.397	27.733	51.672	87.521	0,08	0,08	0,08	0,08					18.297	37.315	61.920	69.202	495.244	540.796	1.007.602	1.706.660
	type	C0002	C0002	C0002	C0002									**10.978**	**22.389**	**37.152**	**41.521**				
Explosives	kg/day	2.518	2.687	7.178	10.241	0,50	0,50	0,50	0,50									314.801	335.855	897.267	1.280.096
	type	C0003	C0003	C0003	C0003																
Caps	#/day	202	202	204	204	1,50	1,50	1,50	1,50									75.750	75.750	76.500	76.500
	type	C0004	C0004	C0004	C0004																
Primers	#/day	202	202	204	204	2,30	2,30	2,30	2,30									116.150	116.150	117.300	117.300
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	1.500	1.500	1.500	1.500	0,25	0,25	0,25	0,25									93.750	93.750	93.750	93.750
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	68.480	162.849	264.475	344.249									68.480	162.849	264.475	344.249
																	Sub Total:	**1.869.925**	**2.629.493**	**4.700.762**	**6.635.835**
Personal Hourly Rate																					
Drillers	n°	6	8	12	8	12,50	12,50	12,50	12,50									300.000	400.000	750.000	500.000
Blasters	n°	3	4	8	16	12,50	12,50	12,50	12,50									150.000	200.000	500.000	1.000.000
Excavator Operators	n°	4	8	8	8	10,63	10,63	10,63	10,63									170.000	340.000	425.000	425.000
Truck Drivers	n°	8	16	16	24	10,63	10,63	10,63	10,63									340.000	680.000	850.000	1.275.000
Equipment Operators	n°	2	2	2	2	10,00	10,00	10,00	10,00									80.000	80.000	100.000	100.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	16	27	30	36	12,50	12,50	12,50	12,50					27.352	50.671	70.618	84.464	783.795	1.366.777	1.890.457	2.236.600
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**2.107.795**	**3.402.777**	**5.051.457**	**6.236.350**

Total Operational: Incl. Equipment	**4.533.943**	**7.129.399**	**11.318.679**	**14.859.999**	**GB£**

Longhole Shaft 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		386.813	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		440.354	0	0	0	0	0	0	0	0	0	440.354	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		32.617	0	0	0	0	0	32.617	0	0	0	0	0	0	32.617	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		6.935	0	0	0	0	0	6.935	0	0	0	0	0	0	6.935	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		11.046	0	0	0	0	0	11.046	0	0	0	0	0	0	11.046	0	0	0	0	0	
Sub total	**0**	**3.851.527**	**0**	**1.878.512**	**0**	**83.485**	**1.878.512**	**521.860**	**0**	**1.878.512**	**83.485**	**1.101.108**	**1.878.512**	**0**	**521.860**	**1.961.997**	**0**	**0**	**1.878.512**	**0**	**0**
Buildings																					
Workshop	236.024																				
Changehouse	1.279.632																				
Office	674.268																				
Stores	116.202																				
Powder Magazine	22.500																				
Hoist Room	203.315																				
Crusher Room (U/G)	1.690.844																				
Sub total	**4.222.785**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	5.200.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development	4.127.547																				
Sub total	**9.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**13.422.785**	**3.851.527**	**0**	**1.878.512**	**0**	**83.485**	**1.878.512**	**521.860**	**0**	**1.878.512**	**83.485**	**1.101.108**	**1.878.512**	**0**	**521.860**	**1.961.997**	**0**	**0**	**1.878.512**	**0**	**0**

Longhole Shaft 1.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	2.707.688
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	3.650.508
Rear-dump Trucks	880.708
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	3.650.508
Rear-dump Trucks	880.708
Equuipment, Misc.	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	97.851
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	20.805
Caplamp Charger Unit	21.098
Self Rescuers	33.137
	0
	0
Sub total	17.517.883
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	674.268
Stores	116.202
Powder Magazine	22.500
Hoist Room	203.315
Crusher Room (U/G)	1.690.844
	0
Sub total	4.222.785
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	5.200.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	4.127.547
Sub total	9.200.000
	0
Total Capital	30.940.667

Longhole Shaft 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		773.625	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.013.838	0	0	0	0	0	0	0	0	0	1.013.838	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.013.838	0	0	0	0	0	0	0	0	0	1.013.838	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		53.445	0	0	0	0	0	53.445	0	0	0	0	0	0	53.445	0	0	0	0	0	
Pickup Trucks		108.530	0	0	0	0	0	0	0	0	0	108.530	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		11.135	0	0	0	0	0	11.135	0	0	0	0	0	0	11.135	0	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	0	0	14.066	0	0	0	0	0	0	14.066	0	0	0	0	0	
Self Rescuers		17.735	0	0	0	0	0	17.735	0	0	0	0	0	0	17.735	0	0	0	0	0	
Sub total	**0**	**7.620.673**	**0**	**4.253.833**	**0**	**83.485**	**4.253.833**	**687.346**	**0**	**4.253.833**	**83.485**	**2.311.525**	**4.253.833**	**0**	**687.346**	**4.337.318**	**0**	**0**	**4.253.833**	**0**	**0**
Buildings																					
Workshop	434.400																				
Changehouse	2.263.500																				
Office	1.159.200																				
Stores	181.000																				
Powder Magazine	45.000																				
Hoist Room	285.740																				
Crusher Room (U/G)	1.690.844																				
Sub total	**6.059.684**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	7.000.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development	5.927.630																				
Sub total	**11.000.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**17.059.684**	**7.620.673**	**0**	**4.253.833**	**0**	**83.485**	**4.253.833**	**687.346**	**0**	**4.253.833**	**83.485**	**2.311.525**	**4.253.833**	**0**	**687.346**	**4.337.318**	**0**	**0**	**4.253.833**	**0**	**0**

Longhole Shaft 2.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	5.415.375
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	10.581.409
Rear-dump Trucks	2.027.677
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	10.581.409
Rear-dump Trucks	2.027.677
Equuipment, Misc.	0
Graders	0
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	160.334
Pickup Trucks	217.060
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	33.404
Caplamp Charger Unit	42.197
Self Rescuers	53.204
	0
	0
Sub total	37.080.344
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	1.159.200
Stores	181.000
Powder Magazine	45.000
Hoist Room	285.740
Crusher Room (U/G)	1.690.844
	0
Sub total	6.059.684
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	7.000.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	5.927.630
Sub total	11.000.000
	0
Total Capital	54.140.028

Longhole Shaft 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	
Rear-dump Trucks		1.294.347	0	0	0	0	0	0	0	1.294.347	0	0	0	0	0	0	0	0	1.294.347	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	140.811	0	0	0	0	0	140.811	0	0	0	0	0	140.811	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.294.347	0	0	0	0	0	0	0	1.294.347	0	0	0	0	0	0	0	0	1.294.347	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		80.167	0	0	0	0	80.167	0	0	0	0	0	80.167	0	0	0	0	0	80.167	0	
Pickup Trucks		108.530	0	0	0	0	0	0	0	108.530	0	0	0	0	0	0	0	0	108.530	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		13.247	0	0	0	13.247	0	0	0	0	13.247	0	0	0	0	13.247	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		21.099	0	0	0	0	21.099	0	0	0	0	0	21.099	0	0	0	0	0	21.099	0	
Sub total	**0**	**8.977.253**	**4.949.196**	**0**	**5.073.936**	**343.957**	**5.387.309**	**0**	**5.073.936**	**2.872.542**	**5.334.408**	**0**	**5.470.794**	**0**	**4.990.451**	**343.957**	**3.521.051**	**0**	**5.195.337**	**0**	**0**
Buildings																					
Workshop	615.400																				
Changehouse	3.319.800																				
Office	1.738.800																				
Stores	289.600																				
Powder Magazine	90.000																				
Hoist Room	450.590																				
Crusher Room (U/G)	1.690.844																				
Sub total	**8.195.034**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	11.300.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development	8.004.908																				
Sub total	**15.300.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**23.495.034**	**8.977.253**	**4.949.196**	**0**	**5.073.936**	**343.957**	**5.387.309**	**0**	**5.073.936**	**2.872.542**	**5.334.408**	**0**	**5.470.794**	**0**	**4.990.451**	**343.957**	**3.521.051**	**0**	**5.195.337**	**0**	**0**

Longhole Shaft 5.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	548.773
Feeders	494.229
Front-end Loaders	13.604.669
Rear-dump Trucks	3.883.041
Equipment, Production	0
Drilling Jumbo's	563.244
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	3.883.041
Equuipment, Misc.	0
Graders	0
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	320.668
Pickup Trucks	325.590
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	330.038
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	52.987
Caplamp Charger Unit	56.262
Self Rescuers	84.395
	0
	0
Sub total	57.534.127
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	1.738.800
Stores	289.600
Powder Magazine	90.000
Hoist Room	450.590
Crusher Room (U/G)	1.690.844
	0
Sub total	8.195.034
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	11.300.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	8.004.908
Sub total	15.300.000
	0
Total Capital	81.029.161

Longhole Shaft 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		82.316	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	1.941.520	0	0	0	0	0	0	0	0	1.941.520	0	
Equipment, Production																					
Drilling Jumbo's		281.622	0	0	0	0	281.622	0	0	0	0	0	281.622	0	0	0	0	0	281.622	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.941.520	0	0	0	0	0	0	0	1.941.520	0	0	0	0	0	0	0	0	1.941.520	0	
Equuipment, Misc.																					
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalers		411.858	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		350.636	0	0	0	0	0	0	0	350.636	0	0	0	0	0	0	0	0	350.636	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		116.180	0	0	0	0	116.180	0	0	0	0	0	116.180	0	0	0	0	0	116.180	0	
Pickup Trucks		217.060	0	0	0	0	0	0	0	217.060	0	0	0	0	0	0	0	0	217.060	0	
Primary Fan		183.611	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		77.009	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	0	0	0	0	
U/G Crusher		467.514	0	0	0	0	467.514	0	0	0	0	0	467.514	0	0	0	0	0	467.514	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Caplamps		17.276	0	0	0	17.276	0	0	0	0	17.276	0	0	0	0	17.276	0	0	0	0	
Caplamp Charger Unit		21.098	0	0	0	21.098	0	0	0	0	21.098	0	0	0	0	21.098	0	0	0	0	
Self Rescuers		27.516	0	0	0	0	27.516	0	0	0	0	0	27.516	0	0	0	0	0	27.516	0	
Sub total	**0**	**11.290.421**	**4.976.635**	**0**	**5.137.129**	**595.469**	**5.627.325**	**0**	**5.137.129**	**4.450.737**	**5.649.113**	**0**	**5.710.810**	**0**	**5.053.644**	**595.469**	**3.548.490**	**0**	**6.977.794**	**0**	**0**
Buildings																					
Workshop	579.200																				
Changehouse	4.941.975																				
Office	2.576.000																				
Stores	271.500																				
Powder Magazine	90.000																				
Hoist Room	879.200																				
Crusher Room (U/G)	3.272.601																				
Sub total	**12.610.476**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	28.200.000																				
Ventilation Shaft	4.000.000																				
U/G Services Infra	0																				
U/G Development	15.343.223																				
Sub total	**32.200.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**44.810.476**	**11.290.421**	**4.976.635**	**0**	**5.137.129**	**595.469**	**5.627.325**	**0**	**5.137.129**	**4.450.737**	**5.649.113**	**0**	**5.710.810**	**0**	**5.053.644**	**595.469**	**3.548.490**	**0**	**6.977.794**	**0**	**0**

Longhole Shaft 14.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	823.159
Feeders	494.229
Front-end Loaders	13.604.669
Rear-dump Trucks	5.824.561
Equipment, Production	0
Drilling Jumbo's	1.126.487
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	5.824.561
Equuipment, Misc.	0
Graders	0
Scalers	1.647.432
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	1.051.907
Misc.	0
Pumps	464.718
Pickup Trucks	651.181
Primary Fan	734.443
Primary Fan Motor	703.520
Secondary Fans	616.072
U/G Crusher	1.870.058
U/G Crusher Motor	0
Feeder	0
Conveyor	0
Caplamps	69.105
Caplamp Charger Unit	84.393
Self Rescuers	110.066
	0
	0
Sub total	64.750.163
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	2.576.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	879.200
Crusher Room (U/G)	3.272.601
	0
Sub total	12.610.476
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	28.200.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	15.343.223
Sub total	32.200.000
	0
Total Capital	109.560.639

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix F4

Disclaimer
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May 2010

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
		Adit	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Shifts per day:		2	2	2	2	2	2	2	2
Workinghours / shift:	hours	8	8	8	8	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20
Hourly Production:	tonnes	94	94	156	156	250	250	700	700
Yearly Production:	Mt	0,4	0,4	0,6	0,6	1,3	1,3	3,5	3,5
In situ Density	tonne/m^3	2,65	2,65	2,65	2,65	2,65	2,65	2,65	2,65
Development									
Main level Face Width	meter	14	14	14	14	15	15	15	15
Main level Face Height	meter	5	5	5	5	5	5	5	5
Main level Depth of Pull	meter	3	3	3	3	4	4	5	5
Sub-level Face Width	meter	5	5	5	5	5	5	5	5
Sub-level Face Height	meter	5	5	5	5	5	5	5	5
Sub-level Face Depth of Pu	meter	3	3	3	3	4	4	5	5
Level Spacing	meter	10	10	10	10	15	15	15	15
Ring Design									
Burden:	m	2,7	2,7	2,7	2,7	3,3	3,3	3,3	3,3
Spacing:	m	3,6	3,6	3,6	3,6	4,3	4,3	4,3	4,3
Number of holes	No.	8	8	8	8	8	8	8	8
Hole Length per ring	m	81	81	81	81	107	107	107	107
Rocktype Overburden:		C	C	C	C	C	C	C	C
Development									
Site Surface Area	hectare	20	20	25	25	35	35	65	65
Lease Area	hectare								
Sub level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Sub Level Developm.	tonnes	143.776	155.171	211.448	222.843	274.495	285.890	536.577	547.972
Production Level									
Drives	meter	1.381	1.553	1.973	2.145	2.595	2.767	3.835	4.007
Production drives	meter	789	789	1.219	1.219	1.548	1.548	4.264	4.264
Raises	meter								
Total Mainlevel Developm.	tonnes	402.573	434.479	592.055	623.961	823.484	857.669	1.609.732	1.643.917
Total Development	tonnes	546.349	589.650	803.503	846.804	1.097.978	1.143.558	2.146.309	2.191.889
Production									
Opening Slots	m3	7.151	7.151	11.918	11.918	23.155	23.155	64.833	64.833
Crusher Room	m3	31.500	31.500	31.500	31.500	31.500	31.500	31.500	31.500
Primary Openings	n^o	1	1	1	1	1	1	1	1
Sinking Code	type	UA0042	UA0032	UA0042	UA0033	UA0042	UA0034	UA0042	UA0035
Ventilation Shafts	n^o	1	1	1	1	1	1	1	1
Sinking Code	type	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036	UA0036
U/G Services Infra	Metre	8.000	8.000	11.000	11.000	16.000	16.000	30.000	30.000
	type	0	0	0	0	0	0	0	0

Longhole		**Daily Production**							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Equipment		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Development									
Drilling Jumbo's Sub level	no	1	1	2	2	3	3	3	3
	type	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090	EU0090
Drilling Jumbo's Main level	no	1	1	1	1	2	2	2	2
	type	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093	EU0093
Drills	no	2	2	2	2	2	2	3	3
	type	EU0081	EU0081	EU0081	EU0081	EU0081	EU0081	EU0082	EU0082
Feeders	no	2	2	2	2	2	2	2	2
	type	EU0083	EU0083	EU0083	EU0083	EU0084	EU0084	EU0084	EU0084
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	E0132	EU0130	E0132	EU0131	E0133	EU0131	E0134	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Production									
Drilling Jumbo's	no	1	1	1	1	1	1	2	2
	type	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095	EU0095
Drills	no								
	type								
Feeders	no								
	type								
Front-end Loaders	no	1	1	2	2	2	2	2	2
	type	EU0130	EU0130	EU0131	EU0131	EU0131	EU0131	EU0131	EU0131
Rear-dump Trucks	no	2	2	4	4	4	4	6	6
	type	E0249	EU0399	E0258	EU0400	E0259	EU0402	E0260	EU0402
Misc.									
Graders	no	1		1		1		1	
	type	EU0114		EU0114		EU0114		EU0114	
Scalers	no	1	1	1	1	1	1	2	2
	type	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360	EU0360
Rockbolters	no	1	1	1	1	1	1	1	1
	type	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351	EU0351
Water Tankers	no								
	type								
Service/Tire Trucks	no								
	type								
ANFO loaders	no	1	1	1	1	1	1	2	2
	type	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428	EU0428
Misc.	no								
	type								
Pumps	no	2	2	2	2	3	3	4	4
	type	B0075	B0075	B0076	B0076	B0076	B0076	B0077	B0077
Pickup Trucks	no	3	3	3	1	3	1	4	2
	type	E0224	E0224	E0224	EU0429	E0224	EU0429	E0224	EU0429
Primary Fan	n^o	1	1	1	1	1	1	1	1
	type	EU0447	EU0447	EU0460	EU0460	EU0460	EU0460	EU0463	EU0463
Primary Fan Motor	n^o	2	2	2	2	2	2	2	2
	type	BU0128	BU0128	BU0138	BU0138	BU0140	BU0140	BU0140	BU0140
Secondary Fans	n^o	2	2	3	3	4	4	8	8
	type	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478	EU0478
U/G Crusher	n^o	1	1	1	1	1	1	1	1
	type	P0301	P0301	P0301	P0301	P0301	P0301	P0303	P0303
U/G Crusher Motor	no	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Feeder	n^o	0	0	0	0	0	0	0	0
	type	0	0	0	0	0	0	0	0
Conveyor	meter	1.650		1.650		1.650		1.650	
	type	BU0476		BU0476		BU0484		BU0490	
Caplamps	n^o	45	50	71	81	87	96	116	125
	type	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010	EU0010
Caplamp Charger Unit	n^o	1	1	2	2	2	2	2	3
	type	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004	EU0004
Self Rescuers	n^o	45	50	71	81	87	96	116	125
	type	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344	EU0344

Longhole		Daily Production							
Daily Production:		**1.500**	**1.500**	**2.500**	**2.500**	**5.000**	**5.000**	**14.000**	**14.000**
Buildings		**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**	**Adit**	**Shaft**
Workshop	m^2	652	652	1.200	1.200	1.700	1.700	1.600	1.600
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m^2	848	848	1.500	1.500	2.200	2.200	3.275	3.275
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m^2	1.047	1.047	1.800	1.800	2.700	2.700	4.000	4.000
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m^2	321	321	500	500	800	800	750	750
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m^2	25	25	50	50	100	100	100	100
	type	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Hoist Room	m^2		185		260		410		800
	type		B0084		B0084		B0084		B0084
Crusher Room (U/G)	n^o	1	1	1	1	1	1	1	1
Consumables									
Diesel Fuel	liter/day	2.605	3.229	6.984	6.380	9.476	11.009	13.044	15.080
Electricity (Incl. Hoisting)	kWh/day	11.869	25.397	23.280	27.733	40.123	51.672	46.720	87.521
Hoisting:	kWh/day	1.485	3.008	1.485	5.344	4.951	14.520	8.665	46.000
Explosives	kg/face	0	0	0	0	0	0	0	0
Powder	kg/day	2.518	2.518	2.687	2.687	7.178	7.178	10.241	10.241
Caps	#/face	8	8	8	8	8	8	8	8
Caps	#/day	202	202	204	204	230	230	248	248
Primers	#/face	8	8	8	8	8	8	8	8
Primers	#/day	202	202	204	204	230	230	248	248
Drill Bits	#/day	0,407	0,407	0,671	0,671	1,028	1,028	3,758	3,758
Det. Cord	m/blast	300	300	300	300	300	300	300	300
Det. Cord	m/day	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
Diesel Fuel	type	C0001	C0001	C0001	C0001	C0001	C0001	C0001	C0001
Electricity	type	C0002	C0002	C0002	C0002	C0002	C0002	C0002	C0002
Explosives	type	C0003	C0003	C0003	C0003	C0003	C0003	C0003	C0003
Caps	type	C0004	C0004	C0004	C0004	C0004	C0004	C0004	C0004
Primers	type	C0005	C0005	C0005	C0005	C0005	C0005	C0005	C0005
Drill Bits	type	C0055	C0055	C0055	C0055	C0055	C0055	C0056	C0056
Det. Cord	type	C0006	C0006	C0006	C0006	C0006	C0006	C0006	C0006
Personal - Hourly Rate									
Drillers	n^o	6	6	8	8	12	12	14	14
Blasters	n^o	3	3	4	4	8	8	16	16
Excavator Operators	n^o	4	4	8	8	8	8	8	8
Truck Drivers	n^o	8	8	16	16	16	16	24	24
Equipment Operators	n^o	2	2	2	2	2	2	2	2
Utility Operators	n^o	1	1	1	1	1	1	1	1
Mechanics	n^o	13	18	21	29	24	32	30	38
Laborers/Maintenance	n^o	2	2	2	2	4	4	6	6
Drillers	type	L0009	L0009	L0009	L0009	L0009	L0009	L0009	L0009
Blasters	type	L0010	L0010	L0010	L0010	L0010	L0010	L0010	L0010
Excavator Operators	type	L0011	L0011	L0011	L0011	L0011	L0011	L0011	L0011
Truck Drivers	type	L0012	L0012	L0012	L0012	L0012	L0012	L0012	L0012
Equipment Operators	type	L0013	L0013	L0013	L0013	L0013	L0013	L0013	L0013
Utility Operators	type	L0014	L0014	L0014	L0014	L0014	L0014	L0014	L0014
Mechanics	type	L0015	L0015	L0015	L0015	L0015	L0015	L0015	L0015
Laborers/Maintenance	type	L0016	L0016	L0016	L0016	L0016	L0016	L0016	L0016
Personel Fixed Wages									
Manager	n^o	1	1	1	1	1	1	1	1
Superintendent	n^o							1	1
Foreman	n^o	1	1	1	1	2	2	2	2
Engineer	n^o			1	1	1	1	1	1
Geologist	n^o								
Supervisor	n^o								
Technician	n^o								
Accountant	n^o								
Clerk	n^o								
Personnel	n^o								
Secretary	n^o								
Security	n^o								
Manager	type	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		41	46	65	73	79	87	106	114

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Equipment		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Drilling Jumbo's Sub level	nº	1	2	3	3	386.813	386.813	386.813	386.813	386.813	773.625	1.160.438	1.160.438	3	3	2	2
	type	EU0090	EU0090	EU0090	EU0090												
Drilling Jumbo's Main level	nº	1	1	2	2	330.599	330.599	330.599	330.599	330.599	330.599	661.199	661.199	3	3	2	2
	type	EU0093	EU0093	EU0093	EU0093												
Drills	nº	2	2	2	3	27.439	27.439	27.439	27.439	54.877	54.877	54.877	82.316	3	3	2	2
	type	EU0081	EU0081	EU0081	EU0082												
Feeders	nº	2	2	2	2	21.984	21.984	24.711	24.711	43.969	43.969	49.423	49.423	3	3	2	2
	type	EU0083	EU0083	EU0084	EU0084												
Front-end Loaders	nº	1	2	2	2	206.779	206.779	432.618	773.625	206.779	413.558	865.236	1.547.250	3	3	4	4
	type	E0132	E0132	E0133	E0134												
Rear-dump Trucks	nº	2	4	4	6	183.666	278.282	344.514	331.713	367.333	1.113.130	1.378.054	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Production		0	0	0	0												
Drilling Jumbo's	nº	1	1	1	2	140.811	140.811	140.811	140.811	140.811	140.811	140.811	281.622	7	7	6	6
	type	EU0095	EU0095	EU0095	EU0095												
Drills	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeders	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Front-end Loaders	nº	1	2	2	2	521.501	755.815	755.815	755.815	521.501	1.511.630	1.511.630	1.511.630	3	3	2	2
	type	EU0130	EU0131	EU0131	EU0131												
Rear-dump Trucks	nº	2	4	4	6	183.666	278.282	344.514	331.713	367.333	1.113.130	1.378.054	1.990.276	11	11	9	9
	type	E0249	E0258	E0259	E0260												
Misc.			0	0	0												
Graders	nº	1	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	133.576	133.576	4	4	3	3
	type	EU0114	EU0114	EU0114	EU0114												
Scalers	nº	1	1	1	2	205.929	205.929	205.929	205.929	205.929	205.929	205.929	411.858	7	7	5	5
	type	EU0360	EU0360	EU0360	EU0360												
Rockbolters	nº	1	1	1	1	83.485	83.485	83.485	83.485	83.485	83.485	83.485	83.485	5	5	4	4
	type	EU0351	EU0351	EU0351	EU0351												
Water Tankers	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Service/Tire Trucks	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
ANFO loaders	nº	1	1	1	2	175.318	175.318	175.318	175.318	175.318	175.318	175.318	350.636	11	11	9	9
	type	EU0428	EU0428	EU0428	EU0428												
Misc.	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Pumps	nº	2	2	3	4	16.308	26.722	26.722	29.045	32.617	53.445	80.167	116.180	7	7	6	6
	type	B0075	B0076	B0076	B0077												
Pickup Trucks	nº	3	3	3	4	15.027	15.027	15.027	15.027	45.082	45.082	45.082	60.109	11	11	9	9
	type	E0224	E0224	E0224	E0224												
Primary Fan	nº	1	1	1	1	90.998	138.028	138.028	183.611	90.998	138.028	138.028	183.611	7	7	5	5
	type	EU0447	EU0460	EU0460	EU0463												
Primary Fan Motor	nº	2	2	2	2	25.752	74.567	87.940	87.940	51.505	149.134	175.880	175.880	7	7	6	6
	type	BU0128	BU0138	BU0140	BU0140												
Secondary Fans	nº	2	3	4	8	9.796	9.796	9.796	9.796	19.252	27.503	41.255	77.009	3	3	2	2
	type	EU0478	EU0478	EU0478	EU0478												
U/G Crusher	nº	1	1	1	1	241.549	241.549	241.549	467.514	241.549	241.549	241.549	467.514	7	7	6	6
	type	P0301	P0301	P0301	P0303												
U/G Crusher Motor	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Feeder	nº	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0												
Conveyor	meter	1650	1650	1650	1650	1.300.222	1.300.222	1.610.863	2.001.718	1.300.222	1.300.222	1.610.863	2.001.718	7	7	6	6
	type	BU0476	BU0476	BU0484	BU0490												
Caplamps	nº	45	71	87	116	138	138	138	138	6.265	9.859	12.029	16.055	7	7	5	5
	type	EU0010	EU0010	EU0010	EU0010												
Caplamp Charger Unit	nº	1	2	2	2	7.033	7.033	7.033	7.033	7.033	14.066	14.066	14.066	7	7	5	5
	type	EU0004	EU0004	EU0004	EU0004												
Self Rescuers	nº	45	71	87	116	220	220	220	220	9.978	15.703	19.160	25.571	7	7	6	6
	type	EU0344	EU0344	EU0344	EU0344												
										4.822.822	**8.088.225**	**10.176.107**	**13.391.695**				

CAPEX		Item				Item Price				Total Costs				Equipment Life			
Longhole Adit Access						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Buildings		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Workshop	m2	652	1.200	1.700	1.600	362	362	362	362	236.024	434.400	615.400	579.200	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Changehouse	m2	848	1.500	2.200	3.275	1.509	1.509	1.509	1.509	1.279.632	2.263.500	3.319.800	4.941.975	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	1.047	1.800	2.700	4.000	644	644	644	644	674.268	1.159.200	1.738.800	2.576.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Stores	m2	321	500	800	750	362	362	362	362	116.202	181.000	289.600	271.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Powder Magazine	m2	25	50	100	100	900	900	900	900	22.500	45.000	90.000	90.000	20	20	20	20
	type	B0041	B0041	B0041	B0041												
Hoist Room	m2	0	0	0	0	0	0	0	0	0	0	0	0				
	type	0	0	0	0												
Crusher Room (U/G)	no	1	1	1	1	1.690.844	1.690.844	1.690.844	3.272.601	1.690.844	1.690.844	1.690.844	3.272.601	20	20	20	20
									Sub Total:	**4.019.470**	**5.773.944**	**7.744.444**	**11.731.276**				
Working Capital																	
25% of OPEX										1.003.221	1.681.627	2.574.887	3.340.451				
									Sub Total:	**1.003.221**	**1.681.627**	**2.574.887**	**3.340.451**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				
Haul Roads/Site Work																	
Decline Lenght	m	1.500	1.500	1.500	1.500	6.500	6.500	6.500	6.500	9.750.000	9.750.000	9.750.000	9.750.000	20	20	20	20
Sinking Code	type	UA0042	UA0042	UA0042	UA0042												
Mob. / Demob.						0	0	0	0	0	0	0	0				
Sink Costs						0	0	0	0	0	0	0	0				
Ventilation Shafts	no	1	1	1	1	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	4.000.000	20	20	20	20
Sinking Code	type	UA0036	UA0036	UA0036	UA0036												
U/G Services Infra	Metre	8.000	11.000	16.000	30.000	0	0	0	0	0	0	0	0				
	type	0	0	0	0					0	0	0	0				
										0	0	0	0				
Total Sub Level Developr	tonnes	143.776	211.448	274.495	536.577					0	0	0	0				
Total Mainlevel Developn	tonnes	402.573	592.055	823.484	1.609.732					0	0	0	0				
Total Development	tonnes	546.349	803.503	1.097.978	2.146.309	7,00	7,00	7,00	7,00	3.824.440	5.624.523	7.685.848	15.024.163				
										17.574.440	**19.374.523**	**21.435.848**	**28.774.163**				

Total Capital: Incl. Equipment	**27.419.952**	**34.918.318**	**41.931.285**	**57.237.584**	**GB£**

Opex		Item				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
Longhole Adit Access						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
Equipment		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Development																					
Drilling Jumbo's Sub level	n°	1	2	3	3	8,49	8,49	8,49	8,49	266	531	996	996	1.680	3.361	6.302	6.302	28.197	56.395	105.740	105.740
	type	EU0090	EU0090	EU0090	EU0090									0	0	0	0				
Drilling Jumbo's Main level	n°	1	1	2	2	7,41	7,41	7,41	7,41	1.129	1.129	2.822	2.822	1.436	1.436	3.589	3.589	24.594	24.594	61.485	61.485
	type	EU0093	EU0093	EU0093	EU0093									0	0	0	0				
Drills	n°	2	2	2	3	3,22	3,22	3,22	4,09	0	0	0	0	331	331	414	621	21.397	21.397	26.747	50.861
	type	EU0081	EU0081	EU0081	EU0082									0	0	0	0				
Feeders	n°	2	2	2	2	0,57	0,57	0,63	0,63	0	0	0	0	266	266	375	375	3.806	3.806	5.266	5.266
	type	EU0083	EU0083	EU0084	EU0084									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	8,62	8,62	16,92	28,59	22.178	44.355	116.283	190.236	559	1.119	2.536	4.537	28.622	57.245	140.432	237.303
	type	E0132	E0132	E0133	E0134									437	875	1.908	2.380				
Rear-dump Trucks	n°	2	4	4	6	4,78	8,02	8,99	9,39	18.658	77.954	97.442	172.557	994	2.410	3.727	5.383	31.708	106.507	149.302	233.931
	type	E0249	E0258	E0259	E0260									443	2.017	2.487	3.781				
Production																					
Drilling Jumbo's	n°	1	1	1	2	7,06	7,06	7,06	7,06	0	0	0	0	611	611	764	1.527	23.449	23.449	29.311	58.621
	type	EU0095	EU0095	EU0095	EU0095									0	0	0	0				
Drills	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeders	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Front-end Loaders	n°	1	2	2	2	28,28	39,37	39,37	39,37	12.787	30.045	37.556	37.556	4.979	14.430	18.037	18.037	93.905	261.426	326.783	326.783
	type	EU0130	EU0131	EU0131	EU0131									567	1.362	1.702	1.702				
Rear-dump Trucks	n°	2	4	4	6	4,78	8,02	8,99	9,39	10.385	43.386	54.233	96.039	994	2.410	3.727	5.383	31.708	106.507	149.302	233.931
	type	E0249	E0258	E0259	E0260									443	2.017	2.487	3.781				
Misc.																					
Graders	n°	1	1	1	1	4,33	4,33	4,33	4,33	1.035	1.035	1.293	1.293	562	562	702	702	14.376	14.376	17.970	17.970
	type	EU0114	EU0114	EU0114	EU0114									233	233	291	291				
Scalers	n°	1	1	1	2	5,89	5,89	5,89	5,89	1.257	1.257	1.571	3.141	910	910	1.137	2.275	19.568	19.568	24.460	48.920
	type	EU0360	EU0360	EU0360	EU0360									240	240	300	600				
Rockbolters	n°	1	1	1	1	5,06	5,06	5,06	5,06	628	628	785	785	1.001	1.001	1.251	1.251	16.796	16.796	20.996	20.996
	type	EU0351	EU0351	EU0351	EU0351									0	0	0	0				
Water Tankers	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Service/Tire Trucks	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
ANFO loaders	n°	1	1	1	2	5,01	5,01	5,01	5,01	1.257	1.257	1.571	3.141	775	775	969	1.938	16.649	16.649	20.811	41.622
	type	EU0428	EU0428	EU0428	EU0428									128	128	160	319				
Misc.	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0	0	0	0	0
Pumps	n°	2	2	3	4	0,59	0,96	0,96	1,05	0	0	0	0	3	4	8	12	3.917	6.356	11.918	17.369
	type	B0075	B0076	B0076	B0077									2.971	3.961	7.427	12.379				
Pickup Trucks	n°	3	3	3	4	0,57	0,57	0,57	0,57	277	277	346	462	4.842	4.842	6.052	8.069	5.710	5.710	7.137	9.516
	type	E0224	E0224	E0224	E0224									113	113	142	189				
Primary Fan	n°	1	1	1	1	3,27	4,97	4,97	6,60	0	0	0	0	1.351	2.046	2.558	3.404	10.847	16.501	20.626	27.394
	type	EU0447	EU0460	EU0460	EU0463									0	0	0	0				
Primary Fan Motor	n°	2	2	2	2	0,72	2,08	2,45	2,45	0	0	0	0	2	5	8	8	4.767	13.822	20.372	20.372
	type	BU0128	BU0138	BU0140	BU0140									11.883	29.709	49.514	49.514				
Secondary Fans	n°	2	3	4	8	0,33	0,33	0,33	0,33	0	0	0	0	284	406	761	1.421	2.179	3.113	5.837	10.895
	type	EU0478	EU0478	EU0478	EU0478									469	670	1.256	2.345				
U/G Crusher	n°	1	1	1	1	15,49	15,49	15,49	28,01	0	0	0	0	9	9	11	21	51.424	51.424	64.280	116.249
	type	P0301	P0301	P0301	P0303									2.971	2.971	3.714	4.951				
U/G Crusher Motor	no	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Feeder	n°	0	0	0	0	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0	0									0	0	0	0				
Conveyor	meter	1650	1650	1650	1650	21,12	21,12	26,17	32,52	0	0	0	0	4.936	4.936	7.644	9.499	70.124	70.124	108.604	134.958
	type	BU0476	BU0476	BU0484	BU0490									1.485	1.485	4.951	8.665				
Caplamps	n°	45	71	87	116	0,00	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0	0	0	0
	type	EU0010	EU0010	EU0010	EU0010									0	0	0	0				
Caplamp Charger Unit	n°	1	2	2	2	0,14	0,14	0,14	0,14	0	0	0	0	38	75	94	94	480	961	1.201	1.201
	type	EU0004	EU0004	EU0004	EU0004									0	0	0	0				
Self Rescuers	n°	45	71	87	116	0,01	0,01	0,01	0,01	0	0	0	0	0	0	0	0	839	1.320	2.013	2.687
	type	EU0344	EU0344	EU0344	EU0344																
										69.855	**201.853**	**314.899**	**509.030**				**Sub Total:**	**505.064**	**898.045**	**1.320.592**	**1.784.069**

Opex Longhole Adit Access		Item				Item Price				Tyre Costs				Labour & Fuel				Total Cost			
						GB£/hr	GB£/hr	GB£/hr	GB£/hr	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	liter / day	liter / day	liter / day	liter / day	1.500	2.500	5.000	14.000
Buildings						GB£/day	GB£/day	GB£/day	GB£/day												
Workshop	m^2	652	1200	1700	1600	3,62	3,62	3,62	3,62									2.360,24	4.344,00	6.154,00	5.792,00
	type	B0081	B0081	B0081	B0081																
Changehouse	m^2	848	1500	2200	3275	15,09	15,09	15,09	15,09									12.796,32	22.635,00	33.198,00	49.419,75
	type	B0087	B0087	B0087	B0087																
Office	m^2	1047	1800	2700	4000	6,44	6,44	6,44	6,44									6.742,68	11.592,00	17.388,00	25.760,00
	type	B0086	B0086	B0086	B0086																
Stores	m^2	321	500	800	750	3,62	3,62	3,62	3,62									1.162,02	1.810,00	2.896,00	2.715,00
	type	B0081	B0081	B0081	B0081																
Powder Magazine	m^2	25	50	100	100	9,00	9,00	9,00	9,00									225,00	450,00	900,00	900,00
	type	B0041	B0041	B0041	B0041																
Hoist Room	m^2	0	0	0	0	0,00	0,00	0,00	0,00									0,00	0,00	0,00	0,00
	type	0	0	0	0	GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Crusher Room (U/G)	n°	1	1	1	1	8.454	8.454	8.454	16.363									8.454,22	8.454	8.454	16.363
																	Sub Total:	**31.740**	**49.285**	**68.990**	**100.950**
Consumables																					
Diesel Fuel	liter/day	2.605	6.984	9.476	13.044	0,76	0,76	0,76	0,76					2.605	6.984	9.476	13.044	495.014	1.326.895	1.800.452	2.478.341
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	11.869	23.280	40.123	46.720	0,08	0,08	0,08	0,08					19.782	38.801	66.871	77.867	231.454	453.967	782.394	911.041
	type	C0002	C0002	C0002	C0002									**11.869**	**23.280**	**40.123**	**46.720**				
Explosives	kg/day	2.518	2.687	7.178	10.241	0,50	0,50	0,50	0,50									314.801	335.855	897.267	1.280.096
	type	C0003	C0003	C0003	C0003																
Caps	#/day	202	202	204	204	1,50	1,50	1,50	1,50									75.750	75.750	76.500	76.500
	type	C0004	C0004	C0004	C0004																
Primers	#/day	202	202	204	204	2,30	2,30	2,30	2,30									116.150	116.150	117.300	117.300
	type	C0005	C0005	C0005	C0005																
Drill Bits	#/day	0	0	1	1	906,64	906,64	906,64	906,64									92.215	92.215	152.100	152.100
	type	C0055	C0055	C0055	C0055																
Det. Cord	m/day	1.500	1.500	1.500	1.500	0,25	0,25	0,25	0,25									93.750	93.750	93.750	93.750
	type	C0006	C0006	C0006	C0006																
Tyres	GB£/year	1	1	1	1	69.855	201.853	314.899	509.030									69.855	201.853	314.899	509.030
																	Sub Total:	**1.488.988**	**2.696.436**	**4.234.661**	**5.618.158**
Personal Hourly Rate																					
Drillers	n°	6	8	12	8	12,50	12,50	12,50	12,50									300.000	400.000	750.000	500.000
Blasters	n°	3	4	8	16	12,50	12,50	12,50	12,50									150.000	200.000	500.000	1.000.000
Excavator Operators	n°	4	8	8	8	10,63	10,63	10,63	10,63									170.000	340.000	425.000	425.000
Truck Drivers	n°	8	16	16	24	10,63	10,63	10,63	10,63									340.000	680.000	850.000	1.275.000
Equipment Operators	n°	2	2	2	2	10,00	10,00	10,00	10,00									80.000	80.000	100.000	100.000
Utility Operators	n°	1	1	1	1	12,50	12,50	12,50	12,50									50.000	50.000	62.500	62.500
Mechanics	n°	13	21	24	30	12,50	12,50	12,50	12,50					26.524	41.870	60.572	74.355	663.090	1.046.741	1.514.306	1.858.877
Laborers/Maintenance	n°	2	2	4	6	9,38	9,38	9,38	9,38									75.000	75.000	187.500	281.250
Personel Fixed Wages																					
Manager	n°	1	1	1	1	84.000	84.000	84.000	84.000									84.000	84.000	84.000	84.000
Superintendent	n°	0	0	0	1	70.000	70.000	70.000	70.000									0	0	0	70.000
Foreman	n°	1	1	2	2	75.000	75.000	75.000	75.000									75.000	75.000	150.000	150.000
Engineer	n°	0	1	1	1	52.000	52.000	52.000	52.000									0	52.000	52.000	52.000
Supervisor	n°	0	0	0	0	39.000	39.000	39.000	39.000									0	0	0	0
Technician	n°	0	0	0	0	52.000	52.000	52.000	52.000									0	0	0	0
Accountant	n°	0	0	0	0	70.000	70.000	70.000	70.000									0	0	0	0
Clerk	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Personnel	n°	0	0	0	0	37.500	37.500	37.500	37.500									0	0	0	0
Secretary	n°	0	0	0	0	27.500	27.500	27.500	27.500									0	0	0	0
Security	n°	0	0	0	0	25.000	25.000	25.000	25.000									0	0	0	0
																	Sub Total:	**1.987.090**	**3.082.741**	**4.675.306**	**5.858.627**

Total Operational: Incl. Equipment	**4.012.883**	**6.726.508**	**10.299.550**	**13.361.805**	**GB£**

Longhole Adit 1.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		386.813	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	0	386.813	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		206.779	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	0	206.779	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		521.501	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	0	521.501	0	
Rear-dump Trucks		367.333	0	0	0	0	0	0	0	0	0	367.333	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		32.617	0	0	0	0	0	32.617	0	0	0	0	0	0	32.617	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		90.998	0	0	0	0	0	90.998	0	0	0	0	0	0	90.998	0	0	0	0	0	
Primary Fan Motor		51.505	0	0	0	0	0	51.505	0	0	0	0	0	0	51.505	0	0	0	0	0	
Secondary Fans		19.252	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	0	19.252	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		6.265	0	0	0	0	0	6.265	0	0	0	0	0	0	6.265	0	0	0	0	0	
Caplamp Charger Unit		7.033	0	0	0	0	0	7.033	0	0	0	0	0	0	7.033	0	0	0	0	0	
Self Rescuers		9.978	0	0	0	0	0	9.978	0	0	0	0	0	0	9.978	0	0	0	0	0	
Sub total	**0**	**4.822.822**	**0**	**1.563.790**	**133.576**	**83.485**	**1.563.790**	**521.860**	**133.576**	**1.563.790**	**83.485**	**955.065**	**1.697.366**	**0**	**521.860**	**1.647.275**	**133.576**	**0**	**1.563.790**	**0**	**0**
Buildings																					
Workshop	236.024																				
Changehouse	1.279.632																				
Office	674.268																				
Stores	116.202																				
Powder Magazine	22.500																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**4.019.470**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development	3.824.440																				
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**17.769.470**	**4.822.822**	**0**	**1.563.790**	**133.576**	**83.485**	**1.563.790**	**521.860**	**133.576**	**1.563.790**	**83.485**	**955.065**	**1.697.366**	**0**	**521.860**	**1.647.275**	**133.576**	**0**	**1.563.790**	**0**	**0**

Longhole Adit 1.500 tpd	**GB£**
Equipment, Development	
Drilling Jumbo's Sub level	2.707.688
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	1.447.452
Rear-dump Trucks	734.665
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	3.650.508
Rear-dump Trucks	734.665
Equuipment, Misc.	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	97.851
Pickup Trucks	90.163
Primary Fan	272.995
Primary Fan Motor	154.514
Secondary Fans	134.766
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	18.794
Caplamp Charger Unit	21.098
Self Rescuers	29.935
	0
	0
Sub total	16.989.103
	0
Buildings	0
Workshop	236.024
Changehouse	1.279.632
Office	674.268
Stores	116.202
Powder Magazine	22.500
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	4.019.470
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	3.824.440
Sub total	13.750.000
	0
Total Capital	34.758.573

Longhole Adit 2.500 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		773.625	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	0	773.625	0	
Drilling Jumbo's Main level		330.599	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	0	330.599	0	
Drills		54.877	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	0	54.877	0	
Feeders		43.969	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	0	43.969	0	
Front-end Loaders		413.558	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	0	413.558	0	
Rear-dump Trucks		1.113.130	0	0	0	0	0	0	0	0	0	1.113.130	0	0	0	0	0	0	0	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	0	140.811	0	0	0	0	0	0	140.811	0	0	0	0	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	0	1.511.630	0	
Rear-dump Trucks		1.113.130	0	0	0	0	0	0	0	0	0	1.113.130	0	0	0	0	0	0	0	0	
Equuipment, Misc.																					
Graders		133.576	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	133.576	0	0	0	
Scalers		205.929	0	0	0	0	0	205.929	0	0	0	0	0	0	205.929	0	0	0	0	0	
Rockbolters		83.485	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	83.485	0	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		53.445	0	0	0	0	0	53.445	0	0	0	0	0	0	53.445	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	
Primary Fan		138.028	0	0	0	0	0	138.028	0	0	0	0	0	0	138.028	0	0	0	0	0	
Primary Fan Motor		149.134	0	0	0	0	0	149.134	0	0	0	0	0	0	149.134	0	0	0	0	0	
Secondary Fans		27.503	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	0	27.503	0	
U/G Crusher		241.549	0	0	0	0	0	241.549	0	0	0	0	0	0	241.549	0	0	0	0	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.300.222	0	0	0	0	0	1.300.222	0	0	0	0	0	0	1.300.222	0	0	0	0	0	
Caplamps		9.859	0	0	0	0	0	9.859	0	0	0	0	0	0	9.859	0	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	0	0	14.066	0	0	0	0	0	0	14.066	0	0	0	0	0	
Self Rescuers		15.703	0	0	0	0	0	15.703	0	0	0	0	0	0	15.703	0	0	0	0	0	
Sub total	**0**	**8.088.225**	**0**	**3.155.761**	**133.576**	**83.485**	**3.155.761**	**687.346**	**133.576**	**3.155.761**	**83.485**	**2.446.659**	**3.289.337**	**0**	**687.346**	**3.239.246**	**133.576**	**0**	**3.155.761**	**0**	**0**
Buildings																					
Workshop	434.400																				
Changehouse	2.263.500																				
Office	1.159.200																				
Stores	181.000																				
Powder Magazine	45.000																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**5.773.944**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development	5.624.523																				
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**19.523.944**	**8.088.225**	**0**	**3.155.761**	**133.576**	**83.485**	**3.155.761**	**687.346**	**133.576**	**3.155.761**	**83.485**	**2.446.659**	**3.289.337**	**0**	**687.346**	**3.239.246**	**133.576**	**0**	**3.155.761**	**0**	**0**

Longhole Adit 2.500 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	5.415.375
Drilling Jumbo's Main level	2.314.196
Drills	384.141
Feeders	307.780
Front-end Loaders	2.894.904
Rear-dump Trucks	2.226.259
Equipment, Production	0
Drilling Jumbo's	422.433
Drills	0
Feeders	0
Front-end Loaders	10.581.409
Rear-dump Trucks	2.226.259
Equuipment, Misc.	0
Graders	667.878
Scalers	617.787
Rockbolters	333.939
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	350.636
Misc.	0
Pumps	160.334
Pickup Trucks	90.163
Primary Fan	414.084
Primary Fan Motor	447.401
Secondary Fans	192.522
U/G Crusher	724.647
U/G Crusher Motor	0
Feeder	0
Conveyor	3.900.665
Caplamps	29.577
Caplamp Charger Unit	42.197
Self Rescuers	47.109
	0
	0
Sub total	31.628.899
	0
Buildings	0
Workshop	434.400
Changehouse	2.263.500
Office	1.159.200
Stores	181.000
Powder Magazine	45.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	5.773.944
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	5.624.523
Sub total	13.750.000
	0
Total Capital	51.152.843

Longhole Adit 5.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		54.877	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	54.877	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		865.236	0	0	865.236	0	0	0	865.236	0	0	0	865.236	0	0	0	865.236	0	0	0	
Rear-dump Trucks		1.378.054	0	0	0	0	0	0	0	1.378.054	0	0	0	0	0	0	0	0	1.378.054	0	
Equipment, Production																					
Drilling Jumbo's		140.811	0	0	0	0	140.811	0	0	0	0	0	140.811	0	0	0	0	0	140.811	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.378.054	0	0	0	0	0	0	0	1.378.054	0	0	0	0	0	0	0	0	1.378.054	0	
Equuipment, Misc.																					
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		205.929	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	205.929	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		175.318	0	0	0	0	0	0	0	175.318	0	0	0	0	0	0	0	0	175.318	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		80.167	0	0	0	0	80.167	0	0	0	0	0	80.167	0	0	0	0	0	80.167	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	45.082	0	0	0	0	0	0	0	0	45.082	0	
Primary Fan		138.028	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	138.028	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		41.255	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	41.255	0	0	0	
U/G Crusher		241.549	0	0	0	0	241.549	0	0	0	0	0	241.549	0	0	0	0	0	241.549	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		1.610.863	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	0	0	0	0	1.610.863	0	
Caplamps		12.029	0	0	0	12.029	0	0	0	0	12.029	0	0	0	0	12.029	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		19.160	0	0	0	0	19.160	0	0	0	0	0	19.160	0	0	0	0	0	19.160	0	
Sub total	**0**	**10.176.107**	**3.437.567**	**133.576**	**4.427.542**	**343.957**	**4.009.255**	**0**	**4.427.542**	**3.110.084**	**3.822.778**	**0**	**4.957.975**	**0**	**3.478.821**	**477.533**	**2.915.912**	**0**	**5.432.878**	**0**	**0**
Buildings																					
Workshop	615.400																				
Changehouse	3.319.800																				
Office	1.738.800																				
Stores	289.600																				
Powder Magazine	90.000																				
Hoist Room	0																				
Crusher Room (U/G)	1.690.844																				
Sub total	**7.744.444**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development	7.685.848																				
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**21.494.444**	**10.176.107**	**3.437.567**	**133.576**	**4.427.542**	**343.957**	**4.009.255**	**0**	**4.427.542**	**3.110.084**	**3.822.778**	**0**	**4.957.975**	**0**	**3.478.821**	**477.533**	**2.915.912**	**0**	**5.432.878**	**0**	**0**

Longhole Adit 5.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	548.773
Feeders	494.229
Front-end Loaders	4.326.178
Rear-dump Trucks	4.134.163
Equipment, Production	0
Drilling Jumbo's	563.244
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	4.134.163
Equuipment, Misc.	0
Graders	935.029
Scalers	823.716
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	525.954
Misc.	0
Pumps	320.668
Pickup Trucks	135.245
Primary Fan	552.112
Primary Fan Motor	703.520
Secondary Fans	371.293
U/G Crusher	966.196
U/G Crusher Motor	0
Feeder	0
Conveyor	6.443.451
Caplamps	48.118
Caplamp Charger Unit	56.262
Self Rescuers	76.639
	0
	0
Sub total	51.151.525
	0
Buildings	0
Workshop	615.400
Changehouse	3.319.800
Office	1.738.800
Stores	289.600
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	1.690.844
	0
Sub total	7.744.444
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	7.685.848
Sub total	13.750.000
	0
Total Capital	72.645.969

Longhole Adit 14.000 tpd	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Equipment, Development																					
Drilling Jumbo's Sub level		1.160.438	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	1.160.438	0	
Drilling Jumbo's Main level		661.199	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	661.199	0	
Drills		82.316	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	82.316	0	
Feeders		49.423	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	49.423	0	
Front-end Loaders		1.547.250	0	0	1.547.250	0	0	0	1.547.250	0	0	0	1.547.250	0	0	0	1.547.250	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	1.990.276	0	0	0	0	0	0	0	0	1.990.276	0	
Equipment, Production																					
Drilling Jumbo's		281.622	0	0	0	0	281.622	0	0	0	0	0	281.622	0	0	0	0	0	281.622	0	
Drills		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		1.511.630	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	1.511.630	0	0	0	0	0	
Rear-dump Trucks		1.990.276	0	0	0	0	0	0	0	1.990.276	0	0	0	0	0	0	0	0	1.990.276	0	
Equuipment, Misc.																					
Graders		133.576	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	0	133.576	0	
Scalers		411.858	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	411.858	0	0	0	0	
Rockbolters		83.485	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	83.485	0	0	0	
Water Tankers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Service/Tire Trucks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ANFO loaders		350.636	0	0	0	0	0	0	0	350.636	0	0	0	0	0	0	0	0	350.636	0	
Misc.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		116.180	0	0	0	0	116.180	0	0	0	0	0	116.180	0	0	0	0	0	116.180	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	60.109	0	0	0	0	0	0	0	0	60.109	0	
Primary Fan		183.611	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	183.611	0	0	0	0	
Primary Fan Motor		175.880	0	0	0	0	175.880	0	0	0	0	0	175.880	0	0	0	0	0	175.880	0	
Secondary Fans		77.009	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	77.009	0	0	0	
U/G Crusher		467.514	0	0	0	0	467.514	0	0	0	0	0	467.514	0	0	0	0	0	467.514	0	
U/G Crusher Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Feeder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Conveyor		2.001.718	0	0	0	0	2.001.718	0	0	0	0	0	2.001.718	0	0	0	0	0	2.001.718	0	
Caplamps		16.055	0	0	0	16.055	0	0	0	0	16.055	0	0	0	0	16.055	0	0	0	0	
Caplamp Charger Unit		14.066	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	14.066	0	0	0	0	
Self Rescuers		25.571	0	0	0	0	25.571	0	0	0	0	0	25.571	0	0	0	0	0	25.571	0	
Sub total	**0**	**13.391.695**	**3.465.005**	**133.576**	**5.172.749**	**595.469**	**4.249.271**	**0**	**5.172.749**	**4.524.871**	**4.137.483**	**0**	**5.880.006**	**0**	**3.542.014**	**729.044**	**3.661.119**	**0**	**7.051.928**	**0**	**0**
Buildings																					
Workshop	579.200																				
Changehouse	4.941.975																				
Office	2.576.000																				
Stores	271.500																				
Powder Magazine	90.000																				
Hoist Room	0																				
Crusher Room (U/G)	3.272.601																				
Sub total	**11.731.276**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
Haul Roads/Site Work																					
Primary Access	9.750.000																				
Ventilation Adit	4.000.000																				
U/G Services Infra	0																				
U/G Development	15.024.163																				
Sub total	**13.750.000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**25.481.276**	**13.391.695**	**3.465.005**	**133.576**	**5.172.749**	**595.469**	**4.249.271**	**0**	**5.172.749**	**4.524.871**	**4.137.483**	**0**	**5.880.006**	**0**	**3.542.014**	**729.044**	**3.661.119**	**0**	**7.051.928**	**0**	**0**

Longhole Adit 14.000 tpd	
	GB£
Equipment, Development	
Drilling Jumbo's Sub level	11.604.375
Drilling Jumbo's Main level	6.611.989
Drills	823.159
Feeders	494.229
Front-end Loaders	7.736.250
Rear-dump Trucks	5.970.827
Equipment, Production	0
Drilling Jumbo's	1.126.487
Drills	0
Feeders	0
Front-end Loaders	12.093.039
Rear-dump Trucks	5.970.827
Equuipment, Misc.	0
Graders	935.029
Scalers	1.647.432
Rockbolters	417.424
Water Tankers	0
Service/Tire Trucks	0
ANFO loaders	1.051.907
Misc.	0
Pumps	464.718
Pickup Trucks	180.327
Primary Fan	734.443
Primary Fan Motor	703.520
Secondary Fans	693.081
U/G Crusher	1.870.058
U/G Crusher Motor	0
Feeder	0
Conveyor	8.006.873
Caplamps	64.220
Caplamp Charger Unit	56.262
Self Rescuers	102.285
	0
	0
Sub total	61.706.978
	0
Buildings	0
Workshop	579.200
Changehouse	4.941.975
Office	2.576.000
Stores	271.500
Powder Magazine	90.000
Hoist Room	0
Crusher Room (U/G)	3.272.601
	0
Sub total	11.731.276
	0
	0
Engineering & Management	0
	0
	0
Sub total	0
	0
	0
Haul Roads/Site Work	0
Primary Access	9.750.000
Ventilation Shaft	4.000.000
U/G Services Infra	0
U/G Development	15.024.163
Sub total	13.750.000
	0
Total Capital	87.188.254

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix G1

May 2010

Processing		Daily Production			
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**
Shifts per day:		2	2	2	2
Workinghours / shift:	hours	8	8	10	10
Workingdays / year:	days	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20
Hourly Production:	tonnes	94	156	250	700
Yearly Production:	mton	0,4	0,6	1,3	3,5
Products					
Scalpings		Scalpings	Scalpings	Scalpings	Scalpings
Unsorted > 40mm	mm	Unsorted > 40mm	Unsorted > 40mm	Unsorted > 40mm	Unsorted > 40mm
Unsorted < 40mm	mm	Unsorted < 40mm	Unsorted < 40mm	Unsorted < 40mm	Unsorted < 40mm
Sorted 40 - 20 mm	mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm
Sorted 20 - 5 mm	mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm
40 mm	mm	40 mm	40 mm	40 mm	40 mm
28 mm	mm	28 mm	28 mm	28 mm	28 mm
20 mm	mm	20 mm	20 mm	20 mm	20 mm
14 mm	mm	14 mm	14 mm	14 mm	14 mm
10 mm	mm	10 mm	10 mm	10 mm	10 mm
6 mm	mm	6 mm	6 mm	6 mm	6 mm
Dust		Dust	Dust	Dust	Dust
Primary					
Primary Crusher	Type	INCLUDED	INCLUDED	INCLUDED	INCLUDED
	No.	IN	IN	IN	IN
	Code	MINE MODEL	MINE MODEL	MINE MODEL	MINE MODEL
Scalping Screen	Type	Double Deck Inclined	Double Deck Inclined	Double Deck Inclined	Double Deck Inclined
	No.	1	1	1	1
	Code	P0095	P0098	P0098	P0109
Screen Motor	No.	1	1	1	1
	Code	BU0096	BU0096	BU0096	BU0098
Secondary					
Secondary Crusher	Type	Hammer	Hammer	Hammer	Gyrotary
	No.	1	1	1	1
	Code	P0208	P0208	P0208	P0214
Secondary Crusher Motor	No.	1	1	1	1
	Code	BU0226	BU0226	BU0226	BU0224
Screen	Type	40mm	40mm	40mm	40mm
	No.	1	1	1	1
	Code	P0048	P0057	P0057	P0089
Screen Motor	No.	1	1	1	1
	Code	BU0094	BU0094	BU0094	BU0098
Crusher	Type	Cone	Cone	Cone	Cone
	No.	1	1	1	1
	Code	P0300	P0300	P0301	P0303
Crusher Motor	No.	1	1	1	1
	Code	BU0218	BU0218	BU0222	BU0224
Conveyor	No.	5	5	5	5
	Code	BU0524	BU0524	BU0524	BU0532
Tertiary					
Screen	Type	0	0	0	0
	No.	1	1	1	1
	Code	0	0	0	0
Screen Motor	No.	1	1	1	1
	Code	0	0	0	0
Tertiary Crusher	Type	Cone	Cone	Cone	Cone
	No.	2	2	2	1
	Code	P0300	P0300	P0301	P0290
Tertiary Crusher Motor	No.	2	2	2	1
	Code	BU0218	BU0218	BU0222	BU0231
Conveyor	No.	6	6	6	6
	Code	BU0524	BU0524	BU0524	BU0532

Processing		**Daily Production**			
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**
Screening					
Screen	Type	Triple Deck	Triple Deck	Triple Deck	Triple Deck
	No.	1	1	1	1
	Code	P0050	P0059	P0059	P0089
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck
	No.	1	1	1	1
	Code	P0049	P0058	P0058	P0065
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck
	No.	1	1	1	1
	Code	P0049	P0058	P0058	P0065
Screen Motor	No.	3	3	3	3
	Code	BU0094	BU0094	BU0094	BU0101
Conveyor	No.	8	8	8	8
	Code	BU0524	BU0524	BU0524	BU0532
Buildings					
Shop	m2	250	250	250	250
	type	B0081	B0081	B0081	B0081
Dry	m2	100	100	100	100
	type	B0087	B0087	B0087	B0087
Office	m2	500	500	500	500
	type	B0086	B0086	B0086	B0086
Warehouse	m2	200	200	200	200
	type	B0081	B0081	B0081	B0081
Storage Bins	m3	300	375	375	500
	No.	12	15	15	20
	Code	B0036	B0036	B0036	B0036
Covered Storage	m2	300	350	700	2.000
	Code	B0037	B0038	B0039	B0040
Weighbridge	No.	1	1	1	1
	Code	B0100	B0100	B0100	B0100
Plant Building	m2	800	1.200	2.000	5.000
	type	B0083	B0083	B0083	B0083
Development					
Access Road	m	100	100	100	100
	Code	B0091	B0092	B0093	B0094
Railhead	m	0	0	0	0
	Code	0	0	0	0
Utilities	m	0	0	0	0
	Code	0	0	0	0
Equipment					
Front-end Loaders	no	2	2	4	6
	type	E0132	E0132	E0132	E0132
Watertruck	no	1	1	1	1
	type	E0239	E0240	E0241	E0242
Pick up trucks	no	1	2	2	3
	type	E0224	E0225	E0226	E0227
Consumables					
Diesel Fuel	Liter/day	151	160	266	381
	type	C0001	C0001	C0001	C0001
Electricity	kWhr/day	13.763	13.763	20.783	27.606
	type	C0002	C0002	C0002	C0002
Personal - Hourly Rate					
Equipment Operators	no	1	2	3	4
Utility Operators	no	1	2	2	2
Mechanics	no	3	3	4	10
Laborers/Maintenance	no	2	2	4	6
Equipment Operators	type	L0017	L0017	L0017	L0017
Utility Operators	type	L0018	L0018	L0018	L0018
Mechanics	type	L0019	L0019	L0019	L0019
Laborers/Maintenance	type	L0020	L0020	L0020	L0020
Personel Fixed Wages					
Manager	no	1	1	1	1
Superintendent	no				1
Foreman	no	1	1	2	2
Engineer	no		1	1	1
Geologist	no				
Supervisor	no				
Technician	no				
Accountant	no				
Clerk	no				
Personnel	no				
Secretary	no				
Security	no				
Manager	type	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032
No. of people on payroll		9	12	17	27

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Daily Production:		1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000	1.500	2.500	5.000	14.000
Primary																	
Primary Crusher	Type No. Code	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	0	0	0	0	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0	0	0	0
Scalping Screen	Type No. Code	Double Deck Inclined 1 P0095	Double Deck Inclined 1 P0098	Double Deck Inclined 1 P0098	Double Deck Inclined 1 P0109	20.482	21.483	21.483	27.439	48.571	50.946	63.683	81.336	6	6	5	5
Screen Motor	No. Code	1 BU0096	1 BU0096	1 BU0096	1 BU0098	729	729	729	901	1.729	1.729	2.161	2.669	6	6	5	5
									Sub Total:	**50.300**	**52.675**	**65.844**	**84.005**				
Secondary																	
Secondary Crusher	Type No. Code	Hammer 1 P0208	Hammer 1 P0208	Hammer 1 P0208	Gyrotary 1 P0214	91.833	91.833	91.833	834.847	217.776	217.776	272.220	2.474.725	6	6	5	10
Secondary Crusher Moto	No. Code	1 BU0226	1 BU0226	1 BU0226	1 BU0224	20.036	20.036	20.036	15.194	47.515	47.515	59.393	45.040	5	5	4	4
Screen	Type No. Code	40mm 1 P0048	40mm 1 P0057	40mm 1 P0057	40mm 1 P0089	11.020	11.910	11.910	41.631	26.133	28.245	35.306	123.406	6	6	5	5
Screen Motor	No. Code	1 BU0094	1 BU0094	1 BU0094	1 BU0098	530	530	530	901	1.258	1.258	1.572	2.669	5	5	4	5
Crusher	Type No. Code	Cone 1 P0300	Cone 1 P0300	Cone 1 P0301	Cone 1 P0303	122.444	122.444	241.549	467.514	290.368	290.368	716.021	1.385.846	6	6	5	5
Crusher Motor	No. Code	1 BU0218	1 BU0218	1 BU0222	1 BU0224	8.090	8.090	12.189	15.194	19.184	19.184	36.131	45.040	5	5	4	4
Conveyor	No. Code	5 BU0524	5 BU0524	5 BU0524	5 BU0532	69.237	69.237	69.237	72.799	820.949	820.949	1.026.186	1.078.980	6	6	5	5
									Sub Total:	**1.423.182**	**1.425.294**	**2.146.829**	**5.155.708**				

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Tertiary																	
Screen	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	No.	1	1	1	1												
	Code	0	0	0	0												
Screen Motor	No.	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Code	0	0	0	0												
Tertiary Crusher	Type	Cone	Cone	Cone	Cone	122.444	122.444	241.549	473.080	580.736	580.736	1.432.041	1.402.344	6	6	5	5
	No.	2	2	2	1												
	Code	P0300	P0300	P0301	P0290												
Tertiary Crusher Motor	No.	2	2	2	1	8.090	8.090	12.189	41.408	38.368	38.368	72.262	122.746	5	5	4	4
	Code	BU0218	BU0218	BU0222	BU0231												
Conveyor	No.	6	6	6	6	69.237	69.237	69.237	72.799	985.139	985.139	1.231.423	1.294.776	6	6	5	5
	Code	BU0524	BU0524	BU0524	BU0532												
									Sub Total:	**1.604.242**	**1.604.242**	**2.735.726**	**2.819.867**				
Screening																	
Screen	Type	Triple Deck	Triple Deck	Triple Deck	Triple Deck	15.306	15.862	15.862	41.631	36.296	37.616	47.020	123.406	6	6	5	5
	No.	1	1	1	1												
	Code	P0050	P0059	P0059	P0089												
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck	12.690	13.358	13.358	26.715	30.093	31.676	39.596	79.191	6	6	5	5
	No.	1	1	1	1												
	Code	P0049	P0058	P0058	P0065												
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck	12.690	13.358	13.358	26.715	30.093	31.676	39.596	79.191	6	6	5	5
	No.	1	1	1	1												
	Code	P0049	P0058	P0058	P0065												
Screen Motor	No.	3	3	3	3	530	530	530	1.738	3.773	3.773	4.717	15.457	5	5	4	5
	Code	BU0094	BU0094	BU0094	BU0101												
Conveyor	No.	8	8	8	8	69.237	69.237	69.237	72.799	1.313.518	1.313.518	1.641.898	1.726.368	6	6	5	5
	Code	BU0524	BU0524	BU0524	BU0532												
									Sub Total:	**1.413.773**	**1.418.261**	**1.772.826**	**2.023.614**				
Buildings																	
Shop	m2	250	250	250	250	362	362	362	362	90.500	90.500	90.500	90.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Dry	m2	100	100	100	100	1.509	1.509	1.509	1.509	150.900	150.900	150.900	150.900	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	500	500	500	500	644	644	644	644	322.000	322.000	322.000	322.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Warehouse	m2	200	200	200	200	362	362	362	362	72.400	72.400	72.400	72.400	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Storage Bins	m3	300	375	375	500	52.317	52.317	52.317	52.317	627.805	784.756	784.756	784.756	10	10	10	10
	No.	12	15	15	20												
	Code	B0036	B0036	B0036	B0036												
Covered Storage	m2	300	350	700	2000	150	170	180	150	45.000	52.500	105.000	105.000	20	20	20	20
	Code	B0037	B0038	B0039	B0040												
Weighbridge	No.	1	1	1	1	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	20	20	20	20
	Code	B0100	B0100	B0100	B0100												
Plant Building	m2	800	1.200	2.000	5.000	661	661	661	661	528.800	793.200	1.322.000	3.305.000	20	20	20	20
	type	B0083	B0083	B0083	B0083												
									Sub Total:	**1.937.405**	**2.366.256**	**2.947.556**	**4.930.556**				

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Access Road	m	100	100	100	100	1.193	1.311	1.756	2.170	282.911	310.894	520.529	643.250	25	25	25	25
	Code	B0091	B0092	B0093	B0094												
Railhead	m	0	0	0	0	0	0	0	0	0	0	0	0	25	25	25	25
	Code	0	0	0	0												
Utilities	m	0	0	0	0	0	0	0	0	0	0	0	0	25	25	25	25
	Code	0	0	0	0												
									Sub Total:	**282.911**	**310.894**	**520.529**	**643.250**				
Equipment																	
Front-end Loaders	no	2	2	4	6	206.779	206.779	206.779	206.779	980.722	980.722	2.451.806	3.677.709	7	7	7	7
	type	E0132	E0132	E0132	E0132												
Watertruck	no	1	1	1	1	133.576	133.576	133.576	133.576	316.765	316.765	395.956	395.956	11	11	9	9
	type	E0239	E0239	E0239	E0239												
Pick up trucks	no	1	2	2	3	15.027	15.027	15.027	15.027	35.636	71.272	89.090	133.635	11	11	9	9
	type	E0224	E0224	E0224	E0224												
									Sub Total:	**1.333.123**	**1.368.759**	**2.936.852**	**4.207.300**				
Working Capital																	
									Sub Total:	**0**	**0**	**0**	**0**				
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**				
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**				

Total Capital: Incl. Equipment	**8.044.937**	**8.546.382**	**13.126.163**	**19.864.301**	**GB£**

OPEX Processing		Items				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£	GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
														kWhr / day	kWhr / day	kWhr / day	kWhr / day				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Primary																					
Primary Crusher	Type No. Code	INCLUDED IN MINE MODEL 0,0	INCLUDED IN MINE MODEL 0	INCLUDED IN MINE MODEL 0	INCLUDED IN MINE MODEL 0	0,00	0,00	0,00	0,00	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0
Scalping Screen	Type No. Code	ouble Deck Incline 1,0 P0095 0,0	ouble Deck Incline 1 P0098 0	ouble Deck Incline 1 P0098 0	ouble Deck Incline 1 P0109 0	0,56	0,58	0,58	0,75	0	0	0	0	153 179	161 179	161 224	205 447	924	970	1.213	1.548
Screen Motor	No. Code	1,0 BU0096 0,0 0,0	1 BU0096 0 0	1 BU0096 0 0	1 BU0098 0 0	0,02	0,02	0,02	0,02	0	0	0	0	7 179	7 179	7 224	9 298	37	37	37	46
Secondary		0,0 0,0	0 0	0 0	0 0																
Secondary Crusher	Type No. Code	Hammer 1,0 P0208 0,0	Hammer 1 P0208 0	Hammer 1 P0208 0	Gyrotary 1 P0214 0	5,92	5,92	5,92	47,68	0	0	0	0	973 5.966	973 5.966	973 7.457	8.855 5.966	9.821	9.821	12.276	98.926
Secondary Crusher Moto	No. Code	1,0 BU0226 0,0	1 BU0226 0	1 BU0226 0	1 BU0224 0	0,56	0,56	0,56	0,42	0	0	0	0	210 5.966	210 5.966	210 7.457	161 5.966	933	933	933	878
Screen	Type No. Code	40mm 1,0 P0048 0,0	40mm 1 P0057 0	40mm 1 P0057 0	40mm 1 P0089 0	0,30	0,32	0,32	1,13	0	0	0	0	82 89	90 89	90 112	311 373	499	536	670	2.344
Screen Motor	No. Code	1,0 BU0094 0,0	1 BU0094 0	1 BU0094 0	1 BU0098 0	0,02	0,02	0,02	0,02	0	0	0	0	4 119	4 119	4 149	9 298	28	28	28	46
Crusher	Type No. Code	Cone 1,0 P0300 0,0	Cone 1 P0300 0	Cone 1 P0301 0	Cone 1 P0303 0	8,57	8,57	15,49	28,01	0	0	0	0	1.299 2.386	1.299 2.386	2.561 4.474	4.959 5.966	14.219	14.219	32.140	58.125
Crusher Motor	No. Code	1,0 BU0218 0,0	1 BU0218 0	1 BU0222 0	1 BU0224 0	0,23	0,23	0,35	0,42	0	0	0	0	84 2.386	84 2.386	129 4.474	161 5.966	379	379	379	878
Conveyor	No. Code	5,0 BU0524 0,0 0,0	5 BU0524 0 0	5 BU0524 0 0	5 BU0532 0 0	2,04	2,04	2,04	2,15	0	0	0	0	0 0	0 0	0 0	0 0	16.954	16.954	16.954	22.347
Tertiary		0,0 0,0	0 0	0 0	0 0																
Screen	Type No. Code	0,0 1,0 0,0 0,0	0 1 0 0	0 1 0 0	0 1 0 0	0,00	0,00	0,00	0,00	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0
Screen Motor	No. Code	1,0 0,0 0,0	1 0 0	1 0 0	1 0 0	0,00	0,00	0,00	0,00	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0
Tertiary Crusher	Type No. Code	Cone 2,0 P0300 0,0	Cone 2 P0300 0	Cone 2 P0301 0	Cone 1 P0290 0	8,57	8,57	15,49	28,32	0	0	0	0	1.299 2.386	1.299 2.386	2.561 4.474	5.017 7.457	28.438	28.438	64.280	58.760
Tertiary Crusher Motor	No. Code	2,0 BU0218 0,0	2 BU0218 0	2 BU0222 0	1 BU0231 0	0,23	0,23	0,35	1,16	0	0	0	0	84 2.386	84 2.386	129 4.474	434 11.185	758	758	758	2.402
Conveyor	No. Code	6,0 BU0524 0,0 0,0	6 BU0524 0 0	6 BU0524 0 0	6 BU0532 0 0	2,04	2,04	2,04	2,15	0	0	0	0	576 239	576 239	576 298	606 447	20.344	20.344	20.344	26.816
Screening		0,0 0,0	0 0	0 0	0 0																
Screen	Type No. Code	Triple Deck 1,0 P0050 0,0	Triple Deck 1 P0059 0	Triple Deck 1 P0059 0	Triple Deck 1 P0089 0	0,42	0,43	0,43	1,13	0	0	0	0	114 119	119 119	119 149	311 373	693	711	889	2.344
Screen	Type No. Code	Double Deck 1,0 P0049 0,0	Double Deck 1 P0058 0	Double Deck 1 P0058 0	Triple Deck 1 P0065 0	0,35	0,36	0,36	0,72	0	0	0	0	95 89	100 89	100 112	200 224	573	601	751	1.501
Screen	Type No. Code	Double Deck 1,0 P0049 0,0	Double Deck 1 P0058 0	Double Deck 1 P0058 0	Triple Deck 1 P0065 0	0,35	0,36	0,36	0,72	0	0	0	0	95 89	100 89	100 112	200 224	573	601	751	1.501
Screen Motor	No. Code	3,0 BU0094 0,0	3 BU0094 0	3 BU0094 0	3 BU0101 0	0,02	0,02	0,02	0,05	0	0	0	0	4 119	4 119	4 149	17 373	83	83	83	312
Conveyor	No. Code	8,0 BU0524	8 BU0524	8 BU0524	8 BU0532	2,04	2,04	2,04	2,15	0	0	0	0	576 239	576 239	576 298	606 447	27.126	27.126	27.126	35.755
																	Sub Total:	**122.379**	**122.537**	**179.610**	**314.529**

OPEX Processing		Items				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£	GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
														kWhr / day	kWhr / day	kWhr / day	kWhr / day				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Shop	m2	250	250	250	250	3,62	3,62	3,62	3,62									905	905	905	905
	type	B0081	B0081	B0081	B0081																
Dry	m2	100	100	100	100	15,09	15,09	15,09	15,09									1.509	1.509	1.509	1.509
	type	B0087	B0087	B0087	B0087																
Office	m2	500	500	500	500	6,44	6,44	6,44	6,44									3.220	3.220	3.220	3.220
	type	B0086	B0086	B0086	B0086																
Warehouse	m2	200	200	200	200	3,62	3,62	3,62	3,62									724	724	724	724
	type	B0081	B0081	B0081	B0081																
Storage Bins	m3	300	375	375	500	0,68	0,68	0,68	0,68									27.052	33.815	42.268	56.358
	No.	12	15	15	20																
	Code	B0036	B0036	B0036	B0036																
Covered Storage	m2	300	350	700	2000	1,50	1,70	1,80	1,50									450	595	1.260	3.000
	Code	B0037	B0038	B0039	B0040																
Weighbridge	No.	1	1	1	1	1000,00	1000,00	1000,00	1000,00									1.000	1.000	1.000	1.000
	Code	B0100	B0100	B0100	B0100																
Plant Building	m2	800	1.200	2.000	5.000	6,61	6,61	6,61	6,61									5.288	7.932	13.220	33.050
	type	B0083	B0083	B0083	B0083																
																		0	0	0	0
																	Sub Total:	**40.148**	**49.700**	**64.106**	**99.766**
Equipment														**liter / day**	**liter / day**	**liter / day**	**liter / day**				
Front-end Loaders	no	2	2	4	6	8,62	8,62	8,62	8,62	5.949	5.949	14.871	22.307	674	674	1.685	2.527	28.622	28.622	57.245	107.334
	type	E0132	E0132	E0132	E0132									105	105	211	316				
Watertruck	no	1	1	1	1	5,11	5,11	5,11	5,11	828	828	1.035	1.035	500	500	625	625	8.481	8.481	8.481	10.602
	type	E0239	E0239	E0239	E0239									36	36	36	36				
Pick up trucks	no	1	2	2	3	0,57	0,57	0,57	0,57	22	45	56	83	49	98	123	184	952	1.903	1.903	3.569
	type	E0224	E0224	E0224	E0224									9	19	19	28				
																	Sub Total:	**38.055**	**39.007**	**67.629**	**121.504**
Power Supply																					
Diesel Fuel	liter/day	151	160	266	381	0,76	0,76	0,76	0,76					151	160	266	381	28.683	30.477	50.496	72.310
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	13.763	13.763	20.783	27.606	0,08	0,08	0,08	0,08				Installed:	22.938	22.938	34.638	46.010	268.371	268.371	405.262	538.313
	type	C0002	C0002	C0002	C0002								**Consumed**	**13.763**	**13.763**	**20.783**	**27.606**				
																	Sub Total:	**297.054**	**298.848**	**455.758**	**610.623**
Tyres																					
Tyres										6.799	6.821	15.962	23.426					6.799	6.821	15.962	23.426
																	Sub Total:	**6.799**	**6.821**	**15.962**	**23.426**
Personal Hourly Rate																					
Equipment Operators	no	1	2	3	4	10,00	10,00	10,00	10,00									20.000	40.000	60.000	100.000
Utility Operators	no	1	2	2	2	11,88	11,88	11,88	11,88									23.750	47.500	47.500	59.375
Mechanics	no	3	3	4	10	11,88	11,88	11,88	11,88					6.879	6.956	10.731	25.395	81.691	82.601	127.431	301.563
Laborers/Maintenance	no	2	2	4	6	8,75	8,75	8,75	8,75									35.000	35.000	70.000	131.250
																	Sub Total:	**160.441**	**205.101**	**304.931**	**592.188**
Personel Fixed Wages																					
Manager	no	1	1	1	1	84.000,00	84.000,00	84.000,00	84.000,00									84.000	84.000	84.000	84.000
Superintendent	no	0	0	0	1	70.000,00	70.000,00	70.000,00	70.000,00									0	0	0	70.000
Foreman	no	1	1	2	2	75.000,00	75.000,00	75.000,00	75.000,00									75.000	75.000	150.000	150.000
Engineer	no	0	1	1	1	52.000,00	52.000,00	52.000,00	52.000,00									0	52.000	52.000	52.000
Geologist	no	0	0	0	0	52.000,00	52.000,00	52.000,00	52.000,00									0	0	0	0
Supervisor	no	0	0	0	0	39.000,00	39.000,00	39.000,00	39.000,00									0	0	0	0
Technician	no	0	0	0	0	52.000,00	52.000,00	52.000,00	52.000,00									0	0	0	0
Accountant	no	0	0	0	0	70.000,00	70.000,00	70.000,00	70.000,00									0	0	0	0
Clerk	no	0	0	0	0	27.500,00	27.500,00	27.500,00	27.500,00									0	0	0	0
Personnel	no	0	0	0	0	37.500,00	37.500,00	37.500,00	37.500,00									0	0	0	0
Secretary	no	0	0	0	0	27.500,00	27.500,00	27.500,00	27.500,00									0	0	0	0
Security	no	0	0	0	0	25.000,00	25.000,00	25.000,00	25.000,00												
																	Sub Total:	**159.000**	**211.000**	**286.000**	**356.000**

Total Operational: Incl. Equipment	**823.877**	**933.014**	**1.373.997**	**2.118.036**	**GB£**

Processing 1.500 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		48.571	0	0	0	0	48.571	0	0	0	0	0	48.571	0	0	0	0	0	48.571	0	
Screen Motor		1.729	0	0	0	0	1.729	0	0	0	0	0	1.729	0	0	0	0	0	1.729	0	
Sub total	**0**	**50.300**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**
Secondary																					
Secondary Crusher		217.776	0	0	0	0	217.776	0	0	0	0	0	217.776	0	0	0	0	0	217.776	0	
Secondary Crusher Motor		47.515	0	0	0	47.515	0	0	0	0	47.515	0	0	0	0	47.515	0	0	0	0	
Screen		26.133	0	0	0	0	26.133	0	0	0	0	0	26.133	0	0	0	0	0	26.133	0	
Screen Motor		1.258	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	
Crusher		290.368	0	0	0	0	290.368	0	0	0	0	0	290.368	0	0	0	0	0	290.368	0	
Crusher Motor		19.184	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Conveyor		820.949	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Sub total	**0**	**1.423.182**	**0**	**0**	**0**	**87.141**	**534.277**	**0**	**0**	**0**	**87.141**	**0**	**534.277**	**0**	**0**	**87.141**	**0**	**0**	**534.277**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		580.736	0	0	0	0	580.736	0	0	0	0	0	580.736	0	0	0	0	0	580.736	0	
Tertiary Crusher Motor		38.368	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	
Conveyor		985.139	0	0	0	0	985.139	0	0	0	0	0	985.139	0	0	0	0	0	985.139	0	
Sub total	**0**	**1.604.242**	**0**	**0**	**0**	**38.368**	**1.565.874**	**0**	**0**	**0**	**38.368**	**0**	**1.565.874**	**0**	**0**	**38.368**	**0**	**0**	**1.565.874**	**0**	**0**
Screening																					
Screen		36.296	0	0	0	0	36.296	0	0	0	0	0	36.296	0	0	0	0	0	36.296	0	
Screen		30.093	0	0	0	0	30.093	0	0	0	0	0	30.093	0	0	0	0	0	30.093	0	
Screen		30.093	0	0	0	0	30.093	0	0	0	0	0	30.093	0	0	0	0	0	30.093	0	
Screen Motor		3.773	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	
Conveyor		1.313.518	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	
Sub total	**0**	**1.413.773**	**0**	**0**	**0**	**3.773**	**1.410.000**	**0**	**0**	**0**	**3.773**	**0**	**1.410.000**	**0**	**0**	**3.773**	**0**	**0**	**1.410.000**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	627.805																				
Covered Storage	45.000																				
Weighbridge	100.000																				
Plant Building	528.800																				
Sub total	**1.937.405**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	282.911																				
Railhead	0																				
Utilities	0																				
Sub total	**282.911**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		980.722	0	0	0	0	0	980.722	0	0	0	0	0	0	980.722	0	0	0	0	0	
Watertruck		316.765	0	0	0	0	0	0	0	0	0	316.765	0	0	0	0	0	0	0	0	
Pick up trucks		35.636	0	0	0	0	0	0	0	0	0	35.636	0	0	0	0	0	0	0	0	
Sub total	**0**	**1.333.123**	**0**	**0**	**0**	**0**	**0**	**980.722**	**0**	**0**	**0**	**352.401**	**0**	**0**	**980.722**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**2.220.316**	**5.824.621**	**0**	**0**	**0**	**129.282**	**3.560.450**	**980.722**	**0**	**0**	**129.282**	**352.401**	**3.560.450**	**0**	**980.722**	**129.282**	**0**	**0**	**3.560.450**	**0**	**0**

Processing 1.500 tpd	GB£
Primary	
Primary Crusher	0
Scalping Screen	194.282
Screen Motor	6.916
Sub total	201.198
Secondary	
Secondary Crusher	871.103
Secondary Crusher Motor	190.059
Screen	104.532
Screen Motor	5.031
Crusher	1.161.471
Crusher Motor	76.736
Conveyor	878.501
Sub total	3.287.434
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	2.322.942
Tertiary Crusher Motor	153.473
Conveyor	3.940.555
Sub total	6.416.970
Screening	
Screen	145.184
Screen	120.371
Screen	120.371
Screen Motor	15.094
Conveyor	5.254.073
Sub total	5.655.092
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	627.805
Covered Storage	45.000
Weighbridge	100.000
Plant Building	528.800
Sub total	1.937.405
Development	
Access Road	282.911
Railhead	0
Utilities	0
Sub total	282.911
Equipment	
Front-end Loaders	2.942.167
Watertruck	633.530
Pick up trucks	71.272
Sub total	3.646.969
Engineering & Management	
	0
Sub total	0
Total Capital	**21.427.980**

Processing 2.500 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		50.946	0	0	0	0	50.946	0	0	0	0	0	50.946	0	0	0	0	0	50.946	0	
Screen Motor		1.729	0	0	0	0	1.729	0	0	0	0	0	1.729	0	0	0	0	0	1.729	0	
Sub total	**0**	**52.675**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**
Secondary																					
Secondary Crusher		217.776	0	0	0	0	217.776	0	0	0	0	0	217.776	0	0	0	0	0	217.776	0	
Secondary Crusher Motor		47.515	0	0	0	47.515	0	0	0	0	47.515	0	0	0	0	47.515	0	0	0	0	
Screen		28.245	0	0	0	0	28.245	0	0	0	0	0	28.245	0	0	0	0	0	28.245	0	
Screen Motor		1.258	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	
Crusher		290.368	0	0	0	0	290.368	0	0	0	0	0	290.368	0	0	0	0	0	290.368	0	
Crusher Motor		19.184	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Conveyor		820.949	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Sub total	**0**	**1.425.294**	**0**	**0**	**0**	**87.141**	**536.388**	**0**	**0**	**0**	**87.141**	**0**	**536.388**	**0**	**0**	**87.141**	**0**	**0**	**536.388**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		580.736	0	0	0	0	580.736	0	0	0	0	0	580.736	0	0	0	0	0	580.736	0	
Tertiary Crusher Motor		38.368	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	
Conveyor		985.139	0	0	0	0	985.139	0	0	0	0	0	985.139	0	0	0	0	0	985.139	0	
Sub total	**0**	**1.604.242**	**0**	**0**	**0**	**38.368**	**1.565.874**	**0**	**0**	**0**	**38.368**	**0**	**1.565.874**	**0**	**0**	**38.368**	**0**	**0**	**1.565.874**	**0**	**0**
Screening																					
Screen		37.616	0	0	0	0	37.616	0	0	0	0	0	37.616	0	0	0	0	0	37.616	0	
Screen		31.676	0	0	0	0	31.676	0	0	0	0	0	31.676	0	0	0	0	0	31.676	0	
Screen		31.676	0	0	0	0	31.676	0	0	0	0	0	31.676	0	0	0	0	0	31.676	0	
Screen Motor		3.773	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	
Conveyor		1.313.518	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	
Sub total	**0**	**1.418.261**	**0**	**0**	**0**	**3.773**	**1.414.487**	**0**	**0**	**0**	**3.773**	**0**	**1.414.487**	**0**	**0**	**3.773**	**0**	**0**	**1.414.487**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	52.500																				
Weighbridge	100.000																				
Plant Building	793.200																				
Sub total	**2.366.256**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	310.894																				
Railhead	0																				
Utilities	0																				
Sub total	**310.894**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		980.722	0	0	0	0	0	980.722	0	0	0	0	0	0	980.722	0	0	0	0	0	
Watertruck		316.765	0	0	0	0	0	0	0	0	0	316.765	0	0	0	0	0	0	0	0	
Pick up trucks		71.272	0	0	0	0	0	0	0	0	0	71.272	0	0	0	0	0	0	0	0	
Sub total	**0**	**1.368.759**	**0**	**0**	**0**	**0**	**0**	**980.722**	**0**	**0**	**0**	**388.037**	**0**	**0**	**980.722**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**2.677.151**	**5.869.232**	**0**	**0**	**0**	**129.282**	**3.569.425**	**980.722**	**0**	**0**	**129.282**	**388.037**	**3.569.425**	**0**	**980.722**	**129.282**	**0**	**0**	**3.569.425**	**0**	**0**

Processing 2.500 tpd	
	GB£
Primary	
Primary Crusher	0
Scalping Screen	203.785
Screen Motor	6.916
Sub total	210.701
Secondary	
Secondary Crusher	871.103
Secondary Crusher Motor	190.059
Screen	112.979
Screen Motor	5.031
Crusher	1.161.471
Crusher Motor	76.736
Conveyor	878.501
Sub total	3.295.882
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	2.322.942
Tertiary Crusher Motor	153.473
Conveyor	3.940.555
Sub total	6.416.970
Screening	
Screen	150.463
Screen	126.706
Screen	126.706
Screen Motor	15.094
Conveyor	5.254.073
Sub total	5.673.042
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	52.500
Weighbridge	100.000
Plant Building	793.200
Sub total	2.366.256
Development	
Access Road	310.894
Railhead	0
Utilities	0
Sub total	310.894
Equipment	
Front-end Loaders	2.942.167
Watertruck	633.530
Pick up trucks	142.544
Sub total	3.718.241
Engineering & Management	
	0
Sub total	0
Total Capital	**21.991.986**

Processing 5.000 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		63.683	0	0	0	63.683	0	0	0	0	63.683	0	0	0	0	63.683	0	0	0	0	
Screen Motor		2.161	0	0	0	2.161	0	0	0	0	2.161	0	0	0	0	2.161	0	0	0	0	
Sub total	**0**	**65.844**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**0**
Secondary																					
Secondary Crusher		272.220	0	0	0	272.220	0	0	0	0	272.220	0	0	0	0	272.220	0	0	0	0	
Secondary Crusher Motor		59.393	0	0	59.393	0	0	0	59.393	0	0	0	59.393	0	0	0	59.393	0	0	0	
Screen		35.306	0	0	0	35.306	0	0	0	0	35.306	0	0	0	0	35.306	0	0	0	0	
Screen Motor		1.572	0	0	1.572	0	0	0	1.572	0	0	0	1.572	0	0	0	1.572	0	0	0	
Crusher		716.021	0	0	0	716.021	0	0	0	0	716.021	0	0	0	0	716.021	0	0	0	0	
Crusher Motor		36.131	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	
Conveyor		1.026.186	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	
Sub total	**0**	**2.146.829**	**0**	**0**	**133.228**	**1.023.546**	**0**	**0**	**133.228**	**0**	**1.023.546**	**0**	**133.228**	**0**	**0**	**1.023.546**	**133.228**	**0**	**0**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		1.432.041	0	0	0	1.432.041	0	0	0	0	1.432.041	0	0	0	0	1.432.041	0	0	0	0	
Tertiary Crusher Motor		72.262	0	0	72.262	0	0	0	72.262	0	0	0	72.262	0	0	0	72.262	0	0	0	
Conveyor		1.231.423	0	0	0	1.231.423	0	0	0	0	1.231.423	0	0	0	0	1.231.423	0	0	0	0	
Sub total	**0**	**2.735.726**	**0**	**0**	**72.262**	**2.663.464**	**0**	**0**	**72.262**	**0**	**2.663.464**	**0**	**72.262**	**0**	**0**	**2.663.464**	**72.262**	**0**	**0**	**0**	**0**
Screening																					
Screen		47.020	0	0	0	47.020	0	0	0	0	47.020	0	0	0	0	47.020	0	0	0	0	
Screen		39.596	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	
Screen		39.596	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	
Screen Motor		4.717	0	0	4.717	0	0	0	4.717	0	0	0	4.717	0	0	0	4.717	0	0	0	
Conveyor		1.641.898	0	0	0	1.641.898	0	0	0	0	1.641.898	0	0	0	0	1.641.898	0	0	0	0	
Sub total	**0**	**1.772.826**	**0**	**0**	**4.717**	**1.768.109**	**0**	**0**	**4.717**	**0**	**1.768.109**	**0**	**4.717**	**0**	**0**	**1.768.109**	**4.717**	**0**	**0**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	105.000																				
Weighbridge	100.000																				
Plant Building	1.322.000																				
Sub total	**2.947.556**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	520.529																				
Railhead	0																				
Utilities	0																				
Sub total	**520.529**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		2.451.806	0	0	0	0	0	2.451.806	0	0	0	0	0	0	2.451.806	0	0	0	0	0	
Watertruck		395.956	0	0	0	0	0	0	0	395.956	0	0	0	0	0	0	0	0	395.956	0	
Pick up trucks		89.090	0	0	0	0	0	0	0	89.090	0	0	0	0	0	0	0	0	89.090	0	
Sub total	**0**	**2.936.852**	**0**	**0**	**0**	**0**	**0**	**2.451.806**	**0**	**485.046**	**0**	**0**	**0**	**0**	**2.451.806**	**0**	**0**	**0**	**485.046**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**3.468.085**	**9.658.078**	**0**	**0**	**210.206**	**5.520.964**	**0**	**2.451.806**	**210.206**	**485.046**	**5.520.964**	**0**	**210.206**	**0**	**2.451.806**	**5.520.964**	**210.206**	**0**	**485.046**	**0**	**0**

Processing 5.000 tpd	GB£
Primary	
Primary Crusher	0
Scalping Screen	254.732
Screen Motor	8.645
Sub total	263.377
Secondary	
Secondary Crusher	1.088.879
Secondary Crusher Motor	296.967
Screen	141.224
Screen Motor	7.861
Crusher	2.864.082
Crusher Motor	180.655
Conveyor	1.170.710
Sub total	5.750.379
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	5.728.164
Tertiary Crusher Motor	361.310
Conveyor	4.925.693
Sub total	11.015.168
Screening	
Screen	188.079
Screen	158.382
Screen	158.382
Screen Motor	23.584
Conveyor	6.567.591
Sub total	7.096.019
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	105.000
Weighbridge	100.000
Plant Building	1.322.000
Sub total	2.947.556
Development	
Access Road	520.529
Railhead	0
Utilities	0
Sub total	520.529
Equipment	
Front-end Loaders	7.355.418
Watertruck	1.187.868
Pick up trucks	267.270
Sub total	8.810.557
Engineering & Management	
	0
Sub total	0
Total Capital	**36.403.585**

Processing 14.000 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		81.336	0	0	0	81.336	0	0	0	0	81.336	0	0	0	0	81.336	0	0	0	0	
Screen Motor		2.669	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	
Sub total	**0**	**84.005**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**0**
Secondary																					
Secondary Crusher		2.474.725	0	0	0	0	0	0	0	0	2.474.725	0	0	0	0	0	0	0	0	0	
Secondary Crusher Motor		45.040	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	
Screen		123.406	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	
Screen Motor		2.669	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	
Crusher		1.385.846	0	0	0	1.385.846	0	0	0	0	1.385.846	0	0	0	0	1.385.846	0	0	0	0	
Crusher Motor		45.040	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	
Conveyor		1.078.980	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	
Sub total	**0**	**5.155.708**	**0**	**0**	**135.120**	**1.511.922**	**0**	**0**	**135.120**	**0**	**3.986.647**	**0**	**135.120**	**0**	**0**	**1.511.922**	**135.120**	**0**	**0**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		1.402.344	0	0	0	1.402.344	0	0	0	0	1.402.344	0	0	0	0	1.402.344	0	0	0	0	
Tertiary Crusher Motor		122.746	0	0	122.746	0	0	0	122.746	0	0	0	122.746	0	0	0	122.746	0	0	0	
Conveyor		1.294.776	0	0	0	1.294.776	0	0	0	0	1.294.776	0	0	0	0	1.294.776	0	0	0	0	
Sub total	**0**	**2.819.867**	**0**	**0**	**122.746**	**2.697.121**	**0**	**0**	**122.746**	**0**	**2.697.121**	**0**	**122.746**	**0**	**0**	**2.697.121**	**122.746**	**0**	**0**	**0**	**0**
Screening																					
Screen		123.406	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	
Screen		79.191	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	
Screen		79.191	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	
Screen Motor		15.457	0	0	0	15.457	0	0	0	0	15.457	0	0	0	0	15.457	0	0	0	0	
Conveyor		1.726.368	0	0	0	1.726.368	0	0	0	0	1.726.368	0	0	0	0	1.726.368	0	0	0	0	
Sub total	**0**	**2.023.614**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	105.000																				
Weighbridge	100.000																				
Plant Building	3.305.000																				
Sub total	**4.930.556**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	643.250																				
Railhead	0																				
Utilities	0																				
Sub total	**643.250**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		3.677.709	0	0	0	0	0	3.677.709	0	0	0	0	0	0	3.677.709	0	0	0	0	0	
Watertruck		395.956	0	0	0	0	0	0	0	395.956	0	0	0	0	0	0	0	0	395.956	0	
Pick up trucks		133.635	0	0	0	0	0	0	0	133.635	0	0	0	0	0	0	0	0	133.635	0	
Sub total	**0**	**4.207.300**	**0**	**0**	**0**	**0**	**0**	**3.677.709**	**0**	**529.591**	**0**	**0**	**0**	**0**	**3.677.709**	**0**	**0**	**0**	**529.591**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**5.573.806**	**14.290.495**	**0**	**0**	**257.866**	**6.316.662**	**0**	**3.677.709**	**257.866**	**529.591**	**8.791.388**	**0**	**257.866**	**0**	**3.677.709**	**6.316.662**	**257.866**	**0**	**529.591**	**0**	**0**

Processing 14.000 tpd	GB£
Primary	
Primary Crusher	0
Scalping Screen	325.344
Screen Motor	10.678
Sub total	336.022
Secondary	
Secondary Crusher	4.949.451
Secondary Crusher Motor	225.200
Screen	493.625
Screen Motor	10.678
Crusher	5.543.385
Crusher Motor	225.200
Conveyor	1.259.140
Sub total	12.706.679
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	5.609.378
Tertiary Crusher Motor	613.732
Conveyor	5.179.105
Sub total	11.402.215
Screening	
Screen	493.625
Screen	316.765
Screen	316.765
Screen Motor	61.829
Conveyor	6.905.474
Sub total	8.094.457
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	105.000
Weighbridge	100.000
Plant Building	3.305.000
Sub total	4.930.556
Development	
Access Road	643.250
Railhead	0
Utilities	0
Sub total	643.250
Equipment	
Front-end Loaders	11.033.128
Watertruck	1.187.868
Pick up trucks	400.906
Sub total	12.621.901
Engineering & Management	
	0
Sub total	0
Total Capital	**50.735.080**

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix G2

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Processing		Daily Production			
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**
Shifts per day:		2	2	2	2
Workinghours / shift:	hours	8	8	10	10
Workingdays / year:	days	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20
Hourly Production:	tonnes	94	156	250	700
Yearly Production:	mton	0,4	0,6	1,3	3,5
Products					
Scalpings		Scalpings	Scalpings	Scalpings	Scalpings
Unsorted > 40mm	mm	Unsorted > 40mm	Unsorted > 40mm	Unsorted > 40mm	Unsorted > 40mm
Unsorted < 40mm	mm	Unsorted < 40mm	Unsorted < 40mm	Unsorted < 40mm	Unsorted < 40mm
Sorted 40 - 20 mm	mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm	Sorted 40 - 20 mm
Sorted 20 - 5 mm	mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm	Sorted 20 - 5 mm
40 mm	mm	40 mm	40 mm	40 mm	40 mm
28 mm	mm	28 mm	28 mm	28 mm	28 mm
20 mm	mm	20 mm	20 mm	20 mm	20 mm
14 mm	mm	14 mm	14 mm	14 mm	14 mm
10 mm	mm	10 mm	10 mm	10 mm	10 mm
6 mm	mm	6 mm	6 mm	6 mm	6 mm
Dust		Dust	Dust	Dust	Dust
Primary					
Primary Crusher	Type	INCLUDED	INCLUDED	INCLUDED	INCLUDED
	No.	IN	IN	IN	IN
	Code	MINE MODEL	MINE MODEL	MINE MODEL	MINE MODEL
Scalping Screen	Type	Double Deck Inclined	Double Deck Inclined	Double Deck Inclined	Double Deck Inclined
	No.	1	1	1	1
	Code	P0095	P0098	P0098	P0109
Screen Motor	No.	1	1	1	1
	Code	BU0096	BU0096	BU0096	BU0098
Secondary					
Secondary Crusher	Type	Gyrotary	Gyrotary	Gyrotary	Gyrotary
	No.	1	1	1	1
	Code	P0214	P0214	P0214	P0218
Secondary Crusher Motor	No.	1	1	1	1
	Code	BU0225	BU0225	BU0228	BU0236
Screen	Type	40mm	40mm	40mm	40mm
	No.	1	1	1	1
	Code	P0048	P0057	P0057	P0089
Screen Motor	No.	1	1	1	1
	Code	BU0094	BU0094	BU0094	BU0098
Crusher	Type	Cone	Cone	Cone	Cone
	No.	1	1	1	1
	Code	P0300	P0300	P0301	P0303
Crusher Motor	No.	1	1	1	1
	Code	BU0218	BU0218	BU0222	BU0224
Conveyor	No.	5	5	5	5
	Code	BU0524	BU0524	BU0524	BU0532
Tertiary					
Screen	Type	0	0	0	0
	No.	1	1	1	1
	Code	0	0	0	0
Screen Motor	No.	1	1	1	1
	Code	0	0	0	0
Tertiary Crusher	Type	Cone	Cone	Cone	Cone
	No.	2	2	2	1
	Code	P0300	P0300	P0301	P0290
Tertiary Crusher Motor	No.	2	2	2	1
	Code	BU0218	BU0218	BU0222	BU0231
Conveyor	No.	6	6	6	6
	Code	BU0524	BU0524	BU0524	BU0532

Processing		Daily Production			
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**
Screening					
Screen	Type	Triple Deck	Triple Deck	Triple Deck	Triple Deck
	No.	1	1	1	1
	Code	P0050	P0059	P0059	P0089
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck
	No.	1	1	1	1
	Code	P0049	P0058	P0058	P0065
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck
	No.	1	1	1	1
	Code	P0049	P0058	P0058	P0065
Screen Motor	No.	3	3	3	3
	Code	BU0094	BU0094	BU0094	BU0101
Conveyor	No.	8	8	8	8
	Code	BU0524	BU0524	BU0524	BU0532
Buildings					
Shop	m2	250	250	250	250
	type	B0081	B0081	B0081	B0081
Dry	m2	100	100	100	100
	type	B0087	B0087	B0087	B0087
Office	m2	500	500	500	500
	type	B0086	B0086	B0086	B0086
Warehouse	m2	200	200	200	200
	type	B0081	B0081	B0081	B0081
Storage Bins	m3	300	375	375	500
	No.	12	15	15	20
	Code	B0036	B0036	B0036	B0036
Covered Storage	m2	300	350	700	2.000
	Code	B0037	B0038	B0039	B0040
Weighbridge	No.	1	1	1	1
	Code	B0100	B0100	B0100	B0100
Plant Building	m2	800	1.200	2.000	5.000
	type	B0083	B0083	B0083	B0083
Development					
Access Road	m	100	100	100	100
	Code	B0091	B0092	B0093	B0094
Railhead	m	0	0	0	0
	Code	0	0	0	0
Utilities	m	0	0	0	0
	Code	0	0	0	0
Equipment					
Front-end Loaders	no	2	2	4	6
	type	E0132	E0132	E0132	E0132
Watertruck	no	1	1	1	1
	type	E0239	E0240	E0241	E0242
Pick up trucks	no	1	2	2	3
	type	E0224	E0225	E0226	E0227
Consumables					
Diesel Fuel	Liter/day	151	160	266	381
	type	C0001	C0001	C0001	C0001
Electricity	kWhr/day	12.331	12.331	19.888	46.397
	type	C0002	C0002	C0002	C0002
Personal - Hourly Rate					
Equipment Operators	no	1	2	3	4
Utility Operators	no	1	2	2	2
Mechanics	no	7	7	7	18
Laborers/Maintenance	no	2	2	4	6
Equipment Operators	type	L0017	L0017	L0017	L0017
Utility Operators	type	L0018	L0018	L0018	L0018
Mechanics	type	L0019	L0019	L0019	L0019
Laborers/Maintenance	type	L0020	L0020	L0020	L0020
Personel Fixed Wages					
Manager	no	1	1	1	1
Superintendent	no				1
Foreman	no	1	1	2	2
Engineer	no		1	1	1
Geologist	no				
Supervisor	no				
Technician	no				
Accountant	no				
Clerk	no				
Personnel	no				
Secretary	no				
Security	no				
Manager	type	L0021	L0021	L0021	L0021
Superintendent	type	L0022	L0022	L0022	L0022
Foreman	type	L0023	L0023	L0023	L0023
Engineer	type	L0024	L0024	L0024	L0024
Geologist	type	L0025	L0025	L0025	L0025
Supervisor	type	L0026	L0026	L0026	L0026
Technician	type	L0027	L0027	L0027	L0027
Accountant	type	L0028	L0028	L0028	L0028
Clerk	type	L0029	L0029	L0029	L0029
Personnel	type	L0030	L0030	L0030	L0030
Secretary	type	L0031	L0031	L0031	L0031
Security	type	L0032	L0032	L0032	L0032
No. of people on payroll		13	16	20	35

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Primary																	
Primary Crusher	Type No. Code	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	INCLUDED IN MINE MODEL	0	0	0	0	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0	0	0	0
Scalping Screen	Type No. Code	Double Deck Inclined 1 P0095	Double Deck Inclined 1 P0098	Double Deck Inclined 1 P0098	Double Deck Inclined 1 P0109	20.482	21.483	21.483	27.439	48.571	50.946	63.683	81.336	6	6	5	5
Screen Motor	No. Code	1 BU0096	1 BU0096	1 BU0096	1 BU0098	729	729	729	901	1.729	1.729	2.161	2.669	6	6	5	5
									Sub Total:	**50.300**	**52.675**	**65.844**	**84.005**				
Secondary																	
Secondary Crusher	Type No. Code	Gyrotary 1 P0214	Gyrotary 1 P0214	Gyrotary 1 P0214	Gyrotary 1 P0218	834.847	834.847	834.847	2.560.198	1.979.780	1.979.780	2.474.725	7.589.158	12	12	10	10
Secondary Crusher Moto	No. Code	1 BU0225	1 BU0225	1 BU0228	1 BU0236	17.843	17.843	25.101	56.046	42.315	42.315	74.407	166.137	5	5	4	4
Screen	Type No. Code	40mm 1 P0048	40mm 1 P0057	40mm 1 P0057	40mm 1 P0089	11.020	11.910	11.910	41.631	26.133	28.245	35.306	123.406	6	6	5	5
Screen Motor	No. Code	1 BU0094	1 BU0094	1 BU0094	1 BU0098	530	530	530	901	1.258	1.258	1.572	2.669	5	5	4	5
Crusher	Type No. Code	Cone 1 P0300	Cone 1 P0300	Cone 1 P0301	Cone 1 P0303	122.444	122.444	241.549	467.514	290.368	290.368	716.021	1.385.846	6	6	5	5
Crusher Motor	No. Code	1 BU0218	1 BU0218	1 BU0222	1 BU0224	8.090	8.090	12.189	15.194	19.184	19.184	36.131	45.040	5	5	4	4
Conveyor	No. Code	5 BU0524	5 BU0524	5 BU0524	5 BU0532	69.237	69.237	69.237	72.799	820.949	820.949	1.026.186	1.078.980	6	6	5	5
									Sub Total:	**3.179.987**	**3.182.098**	**4.364.348**	**10.391.237**				

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£	(Years)			
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Tertiary																	
Screen	Type	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	No.	1	1	1	1												
	Code	0	0	0	0												
Screen Motor	No.	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Code	0	0	0	0												
Tertiary Crusher	Type	Cone	Cone	Cone	Cone	122.444	122.444	241.549	473.080	580.736	580.736	1.432.041	1.402.344	6	6	5	5
	No.	2	2	2	1												
	Code	P0300	P0300	P0301	P0290												
Tertiary Crusher Motor	No.	2	2	2	1	8.090	8.090	12.189	41.408	38.368	38.368	72.262	122.746	5	5	4	4
	Code	BU0218	BU0218	BU0222	BU0231												
Conveyor	No.	6	6	6	6	69.237	69.237	69.237	72.799	985.139	985.139	1.231.423	1.294.776	6	6	5	5
	Code	BU0524	BU0524	BU0524	BU0532												
									Sub Total:	**1.604.242**	**1.604.242**	**2.735.726**	**2.819.867**				
Screening																	
Screen	Type	Triple Deck	Triple Deck	Triple Deck	Triple Deck	15.306	15.862	15.862	41.631	36.296	37.616	47.020	123.406	6	6	5	5
	No.	1	1	1	1												
	Code	P0050	P0059	P0059	P0089												
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck	12.690	13.358	13.358	26.715	30.093	31.676	39.596	79.191	6	6	5	5
	No.	1	1	1	1												
	Code	P0049	P0058	P0058	P0065												
Screen	Type	Double Deck	Double Deck	Double Deck	Triple Deck	12.690	13.358	13.358	26.715	30.093	31.676	39.596	79.191	6	6	5	5
	No.	1	1	1	1												
	Code	P0049	P0058	P0058	P0065												
Screen Motor	No.	3	3	3	3	530	530	530	1.738	3.773	3.773	4.717	15.457	5	5	4	5
	Code	BU0094	BU0094	BU0094	BU0101												
Conveyor	No.	8	8	8	8	69.237	69.237	69.237	72.799	1.313.518	1.313.518	1.641.898	1.726.368	6	6	5	5
	Code	BU0524	BU0524	BU0524	BU0532												
									Sub Total:	**1.413.773**	**1.418.261**	**1.772.826**	**2.023.614**				
Buildings																	
Shop	m2	250	250	250	250	362	362	362	362	90.500	90.500	90.500	90.500	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Dry	m2	100	100	100	100	1.509	1.509	1.509	1.509	150.900	150.900	150.900	150.900	20	20	20	20
	type	B0087	B0087	B0087	B0087												
Office	m2	500	500	500	500	644	644	644	644	322.000	322.000	322.000	322.000	20	20	20	20
	type	B0086	B0086	B0086	B0086												
Warehouse	m2	200	200	200	200	362	362	362	362	72.400	72.400	72.400	72.400	20	20	20	20
	type	B0081	B0081	B0081	B0081												
Storage Bins	m3	300	375	375	500	52.317	52.317	52.317	52.317	627.805	784.756	784.756	784.756	10	10	10	10
	No.	12	15	15	20												
	Code	B0036	B0036	B0036	B0036												
Covered Storage	m2	300	350	700	2000	150	170	180	150	45.000	52.500	105.000	105.000	20	20	20	20
	Code	B0037	B0038	B0039	B0040												
Weighbridge	No.	1	1	1	1	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	20	20	20	20
	Code	B0100	B0100	B0100	B0100												
Plant Building	m2	800	1.200	2.000	5.000	661	661	661	661	528.800	793.200	1.322.000	3.305.000	20	20	20	20
	type	B0083	B0083	B0083	B0083												
									Sub Total:	**1.937.405**	**2.366.256**	**2.947.556**	**4.930.556**				

CAPEX Processing		Items				Item Price				Total Cost				Equipment Life (Years)			
						GB£	GB£	GB£	GB£	GB£	GB£	GB£	GB£				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Development																	
Access Road	m	100	100	100	100	1.193	1.311	1.756	2.170	282.911	310.894	520.529	643.250	25	25	25	25
	Code	B0091	B0092	B0093	B0094												
Railhead	m	0	0	0	0	0	0	0	0	0	0	0	0	25	25	25	25
	Code	0	0	0	0												
Utilities	m	0	0	0	0	0	0	0	0	0	0	0	0	25	25	25	25
	Code	0	0	0	0												
									Sub Total:	**282.911**	**310.894**	**520.529**	**643.250**				
Equipment																	
Front-end Loaders	no	2	2	4	6	206.779	206.779	206.779	206.779	980.722	980.722	2.451.806	3.677.709	7	7	7	7
	type	E0132	E0132	E0132	E0132												
Watertruck	no	1	1	1	1	133.576	133.576	133.576	133.576	316.765	316.765	395.956	395.956	11	11	9	9
	type	E0239	E0239	E0239	E0239												
Pick up trucks	no	1	2	2	3	15.027	15.027	15.027	15.027	35.636	71.272	89.090	133.635	11	11	9	9
	type	E0224	E0224	E0224	E0224												
									Sub Total:	**1.333.123**	**1.368.759**	**2.936.852**	**4.207.300**				
Working Capital																	
									Sub Total:	**0**	**0**	**0**	**0**	25	25	25	25
Engineering & Management																	
									Sub Total:	**0**	**0**	**0**	**0**	25	25	25	25
Contingency																	
									Sub Total:	**0**	**0**	**0**	**0**	25	25	25	25

Total Capital: Incl. Equipment	**9.801.741**	**10.303.187**	**15.343.682**	**25.099.830**	**GB£**

OPEX Processing		Items				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£	GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
														kWhr / day	kWhr / day	kWhr / day	kWhr / day				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Primary																					
Primary Crusher	Type No. Code	INCLUDED IN MINE MODEL 0,0	INCLUDED IN MINE MODEL 0	INCLUDED IN MINE MODEL 0	INCLUDED IN MINE MODEL 0	0,00	0,00	0,00	0,00	#N/A	#N/A	#N/A	#N/A	0 0	0 0	0 0	0 0	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Scalping Screen	Type No. Code	ouble Deck Incline 1,0 P0095 0,0	ouble Deck Incline 1 P0098 0	ouble Deck Incline 1 P0098 0	ouble Deck Incline 1 P0109 0	0,56	0,58	0,58	0,75	#N/A	#N/A	#N/A	#N/A	153 179	161 179	161 224	205 447	1.848	1.940	2.425	3.095
Screen Motor	No. Code	1,0 BU0096 0,0 0,0	1 BU0096 0 0	1 BU0096 0 0	1 BU0098 0 0	0,02	0,02	0,02	0,02	#N/A	#N/A	#N/A	#N/A	7 179	7 179	7 224	9 298	74	74	92	92
Secondary		0,0 0,0	0 0	0 0	0 0																
Secondary Crusher	Type No. Code	Gyrotary 1,0 P0214 0,0	Gyrotary 1 P0214 0	Gyrotary 1 P0214 0	Gyrotary 1 P0218 0	47,68	47,68	47,68	136,51	#N/A	#N/A	#N/A	#N/A	8.855 4.772	8.855 4.772	8.855 5.966	27.154 20.880	158.282	158.282	197.853	566.534
Secondary Crusher Moto	No. Code	1,0 BU0225 0,0	1 BU0225 0	1 BU0228 0	1 BU0236 0	0,50	0,50	0,70	1,56	#N/A	#N/A	#N/A	#N/A	187 4.772	187 4.772	263 7.457	587 22.371	1.645	1.645	2.910	6.490
Screen	Type No. Code	40mm 1,0 P0048 0,0	40mm 1 P0057 0	40mm 1 P0057 0	40mm 1 P0089 0	0,30	0,32	0,32	1,13	#N/A	#N/A	#N/A	#N/A	82 89	90 89	90 112	311 373	998	1.072	1.340	4.689
Screen Motor	No. Code	1,0 BU0094 0,0	1 BU0094 0	1 BU0094 0	1 BU0098 0	0,02	0,02	0,02	0,02	#N/A	#N/A	#N/A	#N/A	4 119	4 119	4 149	9 298	55	55	69	92
Crusher	Type No. Code	Cone 1,0 P0300 0,0	Cone 1 P0300 0	Cone 1 P0301 0	Cone 1 P0303 0	8,57	8,57	15,49	28,01	#N/A	#N/A	#N/A	#N/A	1.299 2.386	1.299 2.386	2.561 4.474	4.959 5.966	28.438	28.438	64.280	116.249
Crusher Motor	No. Code	1,0 BU0218 0,0	1 BU0218 0	1 BU0222 0	1 BU0224 0	0,23	0,23	0,35	0,42	#N/A	#VALUE!	#VALUE!	#VALUE!	84 2.386	84 2.386	129 4.474	161 5.966	758	758	1.432	1.755
Conveyor	No. Code	5,0 BU0524 0,0 0,0	5 BU0524 0 0	5 BU0524 0 0	5 BU0532 0 0	2,04	2,04	2,04	2,15	#N/A	#N/A	#N/A	#N/A	0 0	0 0	0 0	0 0	33.907	33.907	42.384	44.694
Tertiary		0,0 0,0	0 0	0 0	0 0																
Screen	Type No. Code	0,0 1,0 0,0 0,0	0 1 0 0	0 1 0 0	0 1 0 0	0,00	0,00	0,00	0,00	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0
Screen Motor	No. Code	1,0 0,0 0,0	1 0 0	1 0 0	1 0 0	0,00	0,00	0,00	0,00	0	0	0	0	0 0	0 0	0 0	0 0	0	0	0	0
Tertiary Crusher	Type No. Code	Cone 2,0 P0300 0,0	Cone 2 P0300 0	Cone 2 P0301 0	Cone 1 P0290 0	8,57	8,57	15,49	28,32	#N/A	#N/A	#N/A	#N/A	1.299 2.386	1.299 2.386	2.561 4.474	5.017 7.457	56.875	56.875	128.560	117.520
Tertiary Crusher Motor	No. Code	2,0 BU0218 0,0	2 BU0218 0	2 BU0222 0	1 BU0231 0	0,23	0,23	0,35	1,16	#N/A	#N/A	#N/A	#N/A	84 2.386	84 2.386	129 4.474	434 11.185	1.515	1.515	2.864	4.804
Conveyor	No. Code	6,0 BU0524 0,0 0,0	6 BU0524 0 0	6 BU0524 0 0	6 BU0532 0 0	2,04	2,04	2,04	2,15	#N/A	#N/A	#N/A	#N/A	576 239	576 239	576 298	606 447	40.688	40.688	50.861	53.632
Screening		0,0 0,0	0 0	0 0	0 0																
Screen	Type No. Code	Triple Deck 1,0 P0050 0,0	Triple Deck 1 P0059 0	Triple Deck 1 P0059 0	Triple Deck 1 P0089 0	0,42	0,43	0,43	1,13	#N/A	#N/A	#N/A	#N/A	114 119	119 119	119 149	311 373	1.386	1.423	1.779	4.689
Screen	Type No. Code	Double Deck 1,0 P0049 0,0	Double Deck 1 P0058 0	Double Deck 1 P0058 0	Triple Deck 1 P0065 0	0,35	0,36	0,36	0,72	#N/A	#N/A	#N/A	#N/A	95 89	100 89	100 112	200 224	1.146	1.201	1.501	3.003
Screen	Type No. Code	Double Deck 1,0 P0049 0,0	Double Deck 1 P0058 0	Double Deck 1 P0058 0	Triple Deck 1 P0065 0	0,35	0,36	0,36	0,72	#N/A	#N/A	#N/A	#N/A	95 89	100 89	100 112	200 224	1.146	1.201	1.501	3.003
Screen Motor	No. Code	3,0 BU0094 0,0	3 BU0094 0	3 BU0094 0	3 BU0101 0	0,02	0,02	0,02	0,05	#N/A	#N/A	#N/A	#N/A	4 119	4 119	4 149	17 373	166	166	208	624
Conveyor	No. Code	8,0 BU0524	8 BU0524	8 BU0524	8 BU0532	2,04	2,04	2,04	2,15	#N/A	#N/A	#N/A	#N/A	576 239	576 239	576 298	606 447	54.251	54.251	67.814	71.510
																	Sub Total:	**383.177**	**383.491**	**567.874**	**1.002.475**

OPEX Processing		Items				Item Price				Tyre Costs					Labour & Fuel			Total Cost			
						GB£	GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£	GB£
														kWhr / day	kWhr / day	kWhr / day	kWhr / day				
Daily Production:		**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**	**1.500**	**2.500**	**5.000**	**14.000**
Buildings						GB£/yr	GB£/yr	GB£/yr	GB£/yr												
Shop	m2	250	250	250	250	3,62	3,62	3,62	3,62									905	905	905	905
	type	B0081	B0081	B0081	B0081																
Dry	m2	100	100	100	100	15,09	15,09	15,09	15,09									1.509	1.509	1.509	1.509
	type	B0087	B0087	B0087	B0087																
Office	m2	500	500	500	500	6,44	6,44	6,44	6,44									3.220	3.220	3.220	3.220
	type	B0086	B0086	B0086	B0086																
Warehouse	m2	200	200	200	200	3,62	3,62	3,62	3,62									724	724	724	724
	type	B0081	B0081	B0081	B0081																
Storage Bins	m3	300	375	375	500	0,68	0,68	0,68	0,68									27.052	33.815	42.268	56.358
	No.	12	15	15	20																
	Code	B0036	B0036	B0036	B0036																
Covered Storage	m2	300	350	700	2000	1,50	1,70	1,80	1,50									450	595	1.260	3.000
	Code	B0037	B0038	B0039	B0040																
Weighbridge	No.	1	1	1	1	1000,00	1000,00	1000,00	1000,00									1.000	1.000	1.000	1.000
	Code	B0100	B0100	B0100	B0100																
Plant Building	m2	800	1.200	2.000	5.000	6,61	6,61	6,61	6,61									5.288	7.932	13.220	33.050
	type	B0083	B0083	B0083	B0083																
																		0	0	0	0
																	Sub Total:	**40.148**	**49.700**	**64.106**	**99.766**
Equipment														**liter / day**	**liter / day**	**liter / day**	**liter / day**				
Front-end Loaders	no	2	2	4	6	8,62	8,62	8,62	8,62	5.949	5.949	14.871	22.307	674	674	1.685	2.527	28.622	28.622	57.245	107.334
	type	E0132	E0132	E0132	E0132									105	105	211	316				
Watertruck	no	1	1	1	1	5,11	5,11	5,11	5,11	828	828	1.035	1.035	500	500	625	625	8.481	8.481	8.481	10.602
	type	E0239	E0239	E0239	E0239									36	36	36	36				
Pick up trucks	no	1	2	2	3	0,57	0,57	0,57	0,57	22	45	56	83	49	98	123	184	952	1.903	1.903	3.569
	type	E0224	E0224	E0224	E0224									9	19	19	28				
																	Sub Total:	**38.055**	**39.007**	**67.629**	**121.504**
Power Supply																					
Diesel Fuel	liter/day	151	160	266	381	0,76	0,76	0,76	0,76					151	160	266	381	28.683	30.477	50.496	72.310
	type	C0001	C0001	C0001	C0001																
Electricity	kWh/day	12.331	12.331	19.888	46.397	0,08	0,08	0,08	0,08					20.551	20.551	33.146	77.329	240.452	240.452	387.812	904.750
	type	C0002	C0002	C0002	C0002									**12.331**	**12.331**	**19.888**	**46.397**				
																	Sub Total:	**269.135**	**270.929**	**438.309**	**977.060**
Tyres																					
Tyres										6.799	6.821	15.962	23.426					6.799	6.821	15.962	23.426
																	Sub Total:	**6.799**	**6.821**	**15.962**	**23.426**
Personal Hourly Rate																					
Equipment Operators	no	1	2	3	4	10,00	10,00	10,00	10,00									20.000	40.000	60.000	100.000
Utility Operators	no	1	2	2	2	11,88	11,88	11,88	11,88									23.750	47.500	47.500	59.375
Mechanics	no	7	7	7	18	11,88	11,88	11,88	11,88					14.738	14.814	18.666	44.121	175.008	175.918	221.658	523.934
Laborers/Maintenance	no	2	2	4	6	8,75	8,75	8,75	8,75									35.000	35.000	70.000	131.250
																	Sub Total:	**253.758**	**298.418**	**399.158**	**814.559**
Personel Fixed Wages																					
Manager	no	1	1	1	1	84.000,00	84.000,00	84.000,00	84.000,00									84.000	84.000	84.000	84.000
Superintendent	no	0	0	0	1	70.000,00	70.000,00	70.000,00	70.000,00									0	0	0	70.000
Foreman	no	1	1	2	2	75.000,00	75.000,00	75.000,00	75.000,00									75.000	75.000	150.000	150.000
Engineer	no	0	1	1	1	52.000,00	52.000,00	52.000,00	52.000,00									0	52.000	52.000	52.000
Geologist	no	0	0	0	0	52.000,00	52.000,00	52.000,00	52.000,00									0	0	0	0
Supervisor	no	0	0	0	0	39.000,00	39.000,00	39.000,00	39.000,00									0	0	0	0
Technician	no	0	0	0	0	52.000,00	52.000,00	52.000,00	52.000,00									0	0	0	0
Accountant	no	0	0	0	0	70.000,00	70.000,00	70.000,00	70.000,00									0	0	0	0
Clerk	no	0	0	0	0	27.500,00	27.500,00	27.500,00	27.500,00									0	0	0	0
Personnel	no	0	0	0	0	37.500,00	37.500,00	37.500,00	37.500,00									0	0	0	0
Secretary	no	0	0	0	0	27.500,00	27.500,00	27.500,00	27.500,00									0	0	0	0
Security	no	0	0	0	0	25.000,00	25.000,00	25.000,00	25.000,00												
																	Sub Total:	**159.000**	**211.000**	**286.000**	**356.000**
																	Total Operational: Incl. Equipment	**1.150.072**	**1.259.366**	**1.839.038**	**3.394.790**

GB£

Processing 1.500 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		48.571	0	0	0	0	48.571	0	0	0	0	0	48.571	0	0	0	0	0	48.571	0	
Screen Motor		1.729	0	0	0	0	1.729	0	0	0	0	0	1.729	0	0	0	0	0	1.729	0	
Sub total	**0**	**50.300**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**	**0**	**0**	**0**	**50.300**	**0**	**0**
Secondary																					
Secondary Crusher		1.979.780	0	0	0	0	0	0	0	0	0	0	1.979.780	0	0	0	0	0	0	0	
Secondary Crusher Motor		42.315	0	0	0	42.315	0	0	0	0	42.315	0	0	0	0	42.315	0	0	0	0	
Screen		26.133	0	0	0	0	26.133	0	0	0	0	0	26.133	0	0	0	0	0	26.133	0	
Screen Motor		1.258	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	
Crusher		290.368	0	0	0	0	290.368	0	0	0	0	0	290.368	0	0	0	0	0	290.368	0	
Crusher Motor		19.184	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Conveyor		820.949	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Sub total	**0**	**3.179.987**	**0**	**0**	**0**	**81.940**	**316.501**	**0**	**0**	**0**	**81.940**	**0**	**2.296.281**	**0**	**0**	**81.940**	**0**	**0**	**316.501**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		580.736	0	0	0	0	580.736	0	0	0	0	0	580.736	0	0	0	0	0	580.736	0	
Tertiary Crusher Motor		38.368	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	
Conveyor		985.139	0	0	0	0	985.139	0	0	0	0	0	985.139	0	0	0	0	0	985.139	0	
Sub total	**0**	**1.604.242**	**0**	**0**	**0**	**38.368**	**1.565.874**	**0**	**0**	**0**	**38.368**	**0**	**1.565.874**	**0**	**0**	**38.368**	**0**	**0**	**1.565.874**	**0**	**0**
Screening																					
Screen		36.296	0	0	0	0	36.296	0	0	0	0	0	36.296	0	0	0	0	0	36.296	0	
Screen		30.093	0	0	0	0	30.093	0	0	0	0	0	30.093	0	0	0	0	0	30.093	0	
Screen		30.093	0	0	0	0	30.093	0	0	0	0	0	30.093	0	0	0	0	0	30.093	0	
Screen Motor		3.773	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	
Conveyor		1.313.518	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	
Sub total	**0**	**1.413.773**	**0**	**0**	**0**	**3.773**	**1.410.000**	**0**	**0**	**0**	**3.773**	**0**	**1.410.000**	**0**	**0**	**3.773**	**0**	**0**	**1.410.000**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	627.805																				
Covered Storage	45.000																				
Weighbridge	100.000																				
Plant Building	528.800																				
Sub total	**1.937.405**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	282.911																				
Railhead	0																				
Utilities	0																				
Sub total	**282.911**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		980.722	0	0	0	0	0	980.722	0	0	0	0	0	0	980.722	0	0	0	0	0	
Watertruck		316.765	0	0	0	0	0	0	0	0	0	316.765	0	0	0	0	0	0	0	0	
Pick up trucks		35.636	0	0	0	0	0	0	0	0	0	35.636	0	0	0	0	0	0	0	0	
Sub total	**0**	**1.333.123**	**0**	**0**	**0**	**0**	**0**	**980.722**	**0**	**0**	**0**	**352.401**	**0**	**0**	**980.722**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**2.220.316**	**7.581.425**	**0**	**0**	**0**	**124.082**	**3.342.674**	**980.722**	**0**	**0**	**124.082**	**352.401**	**5.322.455**	**0**	**980.722**	**124.082**	**0**	**0**	**3.342.674**	**0**	**0**

Processing 1.500 tpd	
	GB£
Primary	
Primary Crusher	0
Scalping Screen	194.282
Screen Motor	6.916
Sub total	201.198
Secondary	
Secondary Crusher	3.959.561
Secondary Crusher Motor	169.258
Screen	104.532
Screen Motor	5.031
Crusher	1.161.471
Crusher Motor	76.736
Conveyor	878.501
Sub total	6.355.091
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	2.322.942
Tertiary Crusher Motor	153.473
Conveyor	3.940.555
Sub total	6.416.970
Screening	
Screen	145.184
Screen	120.371
Screen	120.371
Screen Motor	15.094
Conveyor	5.254.073
Sub total	5.655.092
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	627.805
Covered Storage	45.000
Weighbridge	100.000
Plant Building	528.800
Sub total	1.937.405
Development	
Access Road	282.911
Railhead	0
Utilities	0
Sub total	282.911
Equipment	
Front-end Loaders	2.942.167
Watertruck	633.530
Pick up trucks	71.272
Sub total	3.646.969
Engineering & Management	
	0
Sub total	0
Total Capital	**24.495.637**

Processing 2.500 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		50.946	0	0	0	0	50.946	0	0	0	0	0	50.946	0	0	0	0	0	50.946	0	
Screen Motor		1.729	0	0	0	0	1.729	0	0	0	0	0	1.729	0	0	0	0	0	1.729	0	
Sub total	**0**	**52.675**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**	**0**	**0**	**0**	**52.675**	**0**	**0**
Secondary																					
Secondary Crusher		1.979.780	0	0	0	0	0	0	0	0	0	0	1.979.780	0	0	0	0	0	0	0	
Secondary Crusher Motor		42.315	0	0	0	42.315	0	0	0	0	42.315	0	0	0	0	42.315	0	0	0	0	
Screen		28.245	0	0	0	0	28.245	0	0	0	0	0	28.245	0	0	0	0	0	28.245	0	
Screen Motor		1.258	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	1.258	0	0	0	0	
Crusher		290.368	0	0	0	0	290.368	0	0	0	0	0	290.368	0	0	0	0	0	290.368	0	
Crusher Motor		19.184	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Conveyor		820.949	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	19.184	0	0	0	0	
Sub total	**0**	**3.182.098**	**0**	**0**	**0**	**81.940**	**318.613**	**0**	**0**	**0**	**81.940**	**0**	**2.298.393**	**0**	**0**	**81.940**	**0**	**0**	**318.613**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		580.736	0	0	0	0	580.736	0	0	0	0	0	580.736	0	0	0	0	0	580.736	0	
Tertiary Crusher Motor		38.368	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	38.368	0	0	0	0	
Conveyor		985.139	0	0	0	0	985.139	0	0	0	0	0	985.139	0	0	0	0	0	985.139	0	
Sub total	**0**	**1.604.242**	**0**	**0**	**0**	**38.368**	**1.565.874**	**0**	**0**	**0**	**38.368**	**0**	**1.565.874**	**0**	**0**	**38.368**	**0**	**0**	**1.565.874**	**0**	**0**
Screening																					
Screen		37.616	0	0	0	0	37.616	0	0	0	0	0	37.616	0	0	0	0	0	37.616	0	
Screen		31.676	0	0	0	0	31.676	0	0	0	0	0	31.676	0	0	0	0	0	31.676	0	
Screen		31.676	0	0	0	0	31.676	0	0	0	0	0	31.676	0	0	0	0	0	31.676	0	
Screen Motor		3.773	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	3.773	0	0	0	0	
Conveyor		1.313.518	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	0	0	0	0	1.313.518	0	
Sub total	**0**	**1.418.261**	**0**	**0**	**0**	**3.773**	**1.414.487**	**0**	**0**	**0**	**3.773**	**0**	**1.414.487**	**0**	**0**	**3.773**	**0**	**0**	**1.414.487**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	52.500																				
Weighbridge	100.000																				
Plant Building	793.200																				
Sub total	**2.366.256**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	310.894																				
Railhead	0																				
Utilities	0																				
Sub total	**310.894**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		980.722	0	0	0	0	0	980.722	0	0	0	0	0	0	980.722	0	0	0	0	0	
Watertruck		316.765	0	0	0	0	0	0	0	0	0	316.765	0	0	0	0	0	0	0	0	
Pick up trucks		71.272	0	0	0	0	0	0	0	0	0	71.272	0	0	0	0	0	0	0	0	
Sub total	**0**	**1.368.759**	**0**	**0**	**0**	**0**	**0**	**980.722**	**0**	**0**	**0**	**388.037**	**0**	**0**	**980.722**	**0**	**0**	**0**	**0**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**2.677.151**	**7.626.036**	**0**	**0**	**0**	**124.082**	**3.351.649**	**980.722**	**0**	**0**	**124.082**	**388.037**	**5.331.430**	**0**	**980.722**	**124.082**	**0**	**0**	**3.351.649**	**0**	**0**

Processing 2.500 tpd	
	GB£
Primary	
Primary Crusher	0
Scalping Screen	203.785
Screen Motor	6.916
Sub total	210.701
Secondary	
Secondary Crusher	3.959.561
Secondary Crusher Motor	169.258
Screen	112.979
Screen Motor	5.031
Crusher	1.161.471
Crusher Motor	76.736
Conveyor	878.501
Sub total	6.363.538
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	2.322.942
Tertiary Crusher Motor	153.473
Conveyor	3.940.555
Sub total	6.416.970
Screening	
Screen	150.463
Screen	126.706
Screen	126.706
Screen Motor	15.094
Conveyor	5.254.073
Sub total	5.673.042
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	52.500
Weighbridge	100.000
Plant Building	793.200
Sub total	2.366.256
Development	
Access Road	310.894
Railhead	0
Utilities	0
Sub total	310.894
Equipment	
Front-end Loaders	2.942.167
Watertruck	633.530
Pick up trucks	142.544
Sub total	3.718.241
Engineering & Management	
	0
Sub total	0
Total Capital	**25.059.643**

Processing 5.000 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		63.683	0	0	0	63.683	0	0	0	0	63.683	0	0	0	0	63.683	0	0	0	0	
Screen Motor		2.161	0	0	0	2.161	0	0	0	0	2.161	0	0	0	0	2.161	0	0	0	0	
Sub total	**0**	**65.844**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**65.844**	**0**	**0**	**0**	**0**	**0**
Secondary																					
Secondary Crusher		2.474.725	0	0	0	0	0	0	0	0	2.474.725	0	0	0	0	0	0	0	0	0	
Secondary Crusher Motor		74.407	0	0	74.407	0	0	0	74.407	0	0	0	74.407	0	0	0	74.407	0	0	0	
Screen		35.306	0	0	0	35.306	0	0	0	0	35.306	0	0	0	0	35.306	0	0	0	0	
Screen Motor		1.572	0	0	1.572	0	0	0	1.572	0	0	0	1.572	0	0	0	1.572	0	0	0	
Crusher		716.021	0	0	0	716.021	0	0	0	0	716.021	0	0	0	0	716.021	0	0	0	0	
Crusher Motor		36.131	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	
Conveyor		1.026.186	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	36.131	0	0	0	
Sub total	**0**	**4.364.348**	**0**	**0**	**148.241**	**751.327**	**0**	**0**	**148.241**	**0**	**3.226.052**	**0**	**148.241**	**0**	**0**	**751.327**	**148.241**	**0**	**0**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		1.432.041	0	0	0	1.432.041	0	0	0	0	1.432.041	0	0	0	0	1.432.041	0	0	0	0	
Tertiary Crusher Motor		72.262	0	0	72.262	0	0	0	72.262	0	0	0	72.262	0	0	0	72.262	0	0	0	
Conveyor		1.231.423	0	0	0	1.231.423	0	0	0	0	1.231.423	0	0	0	0	1.231.423	0	0	0	0	
Sub total	**0**	**2.735.726**	**0**	**0**	**72.262**	**2.663.464**	**0**	**0**	**72.262**	**0**	**2.663.464**	**0**	**72.262**	**0**	**0**	**2.663.464**	**72.262**	**0**	**0**	**0**	**0**
Screening																					
Screen		47.020	0	0	0	47.020	0	0	0	0	47.020	0	0	0	0	47.020	0	0	0	0	
Screen		39.596	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	
Screen		39.596	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	39.596	0	0	0	0	
Screen Motor		4.717	0	0	4.717	0	0	0	4.717	0	0	0	4.717	0	0	0	4.717	0	0	0	
Conveyor		1.641.898	0	0	0	1.641.898	0	0	0	0	1.641.898	0	0	0	0	1.641.898	0	0	0	0	
Sub total	**0**	**1.772.826**	**0**	**0**	**4.717**	**1.768.109**	**0**	**0**	**4.717**	**0**	**1.768.109**	**0**	**4.717**	**0**	**0**	**1.768.109**	**4.717**	**0**	**0**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	105.000																				
Weighbridge	100.000																				
Plant Building	1.322.000																				
Sub total	**2.947.556**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	520.529																				
Railhead	0																				
Utilities	0																				
Sub total	**520.529**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		2.451.806	0	0	0	0	0	2.451.806	0	0	0	0	0	0	2.451.806	0	0	0	0	0	
Watertruck		395.956	0	0	0	0	0	0	0	395.956	0	0	0	0	0	0	0	0	395.956	0	
Pick up trucks		89.090	0	0	0	0	0	0	0	89.090	0	0	0	0	0	0	0	0	89.090	0	
Sub total	**0**	**2.936.852**	**0**	**0**	**0**	**0**	**0**	**2.451.806**	**0**	**485.046**	**0**	**0**	**0**	**0**	**2.451.806**	**0**	**0**	**0**	**485.046**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**3.468.085**	**11.875.597**	**0**	**0**	**225.220**	**5.248.744**	**0**	**2.451.806**	**225.220**	**485.046**	**7.723.470**	**0**	**225.220**	**0**	**2.451.806**	**5.248.744**	**225.220**	**0**	**485.046**	**0**	**0**

Processing 5.000 tpd	
	GB£
Primary	
Primary Crusher	0
Scalping Screen	254.732
Screen Motor	8.645
Sub total	263.377
Secondary	
Secondary Crusher	4.949.451
Secondary Crusher Motor	372.034
Screen	141.224
Screen Motor	7.861
Crusher	2.864.082
Crusher Motor	180.655
Conveyor	1.170.710
Sub total	9.686.017
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	5.728.164
Tertiary Crusher Motor	361.310
Conveyor	4.925.693
Sub total	11.015.168
Screening	
Screen	188.079
Screen	158.382
Screen	158.382
Screen Motor	23.584
Conveyor	6.567.591
Sub total	7.096.019
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	105.000
Weighbridge	100.000
Plant Building	1.322.000
Sub total	2.947.556
Development	
Access Road	520.529
Railhead	0
Utilities	0
Sub total	520.529
Equipment	
Front-end Loaders	7.355.418
Watertruck	1.187.868
Pick up trucks	267.270
Sub total	8.810.557
Engineering & Management	
	0
Sub total	0
Total Capital	**40.339.223**

Processing 14.000 tpd	CAPEX																				
Daily Production	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Primary																					
Primary Crusher			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scalping Screen		81.336	0	0	0	81.336	0	0	0	0	81.336	0	0	0	0	81.336	0	0	0	0	
Screen Motor		2.669	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	
Sub total	**0**	**84.005**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**84.005**	**0**	**0**	**0**	**0**	**0**
Secondary																					
Secondary Crusher		7.589.158	0	0	0	0	0	0	0	0	7.589.158	0	0	0	0	0	0	0	0	0	
Secondary Crusher Motor		166.137	0	0	166.137	0	0	0	166.137	0	0	0	166.137	0	0	0	166.137	0	0	0	
Screen		123.406	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	
Screen Motor		2.669	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	2.669	0	0	0	0	
Crusher		1.385.846	0	0	0	1.385.846	0	0	0	0	1.385.846	0	0	0	0	1.385.846	0	0	0	0	
Crusher Motor		45.040	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	
Conveyor		1.078.980	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	45.040	0	0	0	
Sub total	**0**	**10.391.237**	**0**	**0**	**256.217**	**1.511.922**	**0**	**0**	**256.217**	**0**	**9.101.080**	**0**	**256.217**	**0**	**0**	**1.511.922**	**256.217**	**0**	**0**	**0**	**0**
Tertiary																					
Screen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Screen Motor		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tertiary Crusher		1.402.344	0	0	0	1.402.344	0	0	0	0	1.402.344	0	0	0	0	1.402.344	0	0	0	0	
Tertiary Crusher Motor		122.746	0	0	122.746	0	0	0	122.746	0	0	0	122.746	0	0	0	122.746	0	0	0	
Conveyor		1.294.776	0	0	0	1.294.776	0	0	0	0	1.294.776	0	0	0	0	1.294.776	0	0	0	0	
Sub total	**0**	**2.819.867**	**0**	**0**	**122.746**	**2.697.121**	**0**	**0**	**122.746**	**0**	**2.697.121**	**0**	**122.746**	**0**	**0**	**2.697.121**	**122.746**	**0**	**0**	**0**	**0**
Screening																					
Screen		123.406	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	123.406	0	0	0	0	
Screen		79.191	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	
Screen		79.191	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	79.191	0	0	0	0	
Screen Motor		15.457	0	0	0	15.457	0	0	0	0	15.457	0	0	0	0	15.457	0	0	0	0	
Conveyor		1.726.368	0	0	0	1.726.368	0	0	0	0	1.726.368	0	0	0	0	1.726.368	0	0	0	0	
Sub total	**0**	**2.023.614**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**2.023.614**	**0**	**0**	**0**	**0**	**0**
Buildings																					
Shop	90.500																				
Dry	150.900																				
Office	322.000																				
Warehouse	72.400																				
Storage Bins	784.756																				
Covered Storage	105.000																				
Weighbridge	100.000																				
Plant Building	3.305.000																				
Sub total	**4.930.556**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Development																					
Access Road	643.250																				
Railhead	0																				
Utilities	0																				
Sub total	**643.250**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Equipment																					
Front-end Loaders		3.677.709	0	0	0	0	0	3.677.709	0	0	0	0	0	0	3.677.709	0	0	0	0	0	
Watertruck		395.956	0	0	0	0	0	0	0	395.956	0	0	0	0	0	0	0	0	395.956	0	
Pick up trucks		133.635	0	0	0	0	0	0	0	133.635	0	0	0	0	0	0	0	0	133.635	0	
Sub total	**0**	**4.207.300**	**0**	**0**	**0**	**0**	**0**	**3.677.709**	**0**	**529.591**	**0**	**0**	**0**	**0**	**3.677.709**	**0**	**0**	**0**	**529.591**	**0**	**0**
Engineering & Management																					
	0																				
Sub total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Capital	**5.573.806**	**19.526.024**	**0**	**0**	**378.963**	**6.316.662**	**0**	**3.677.709**	**378.963**	**529.591**	**13.905.820**	**0**	**378.963**	**0**	**3.677.709**	**6.316.662**	**378.963**	**0**	**529.591**	**0**	**0**

Processing 14.000 tpd	
	GB£
Primary	
Primary Crusher	0
Scalping Screen	325.344
Screen Motor	10.678
Sub total	336.022
Secondary	
Secondary Crusher	15.178.316
Secondary Crusher Motor	830.683
Screen	493.625
Screen Motor	10.678
Crusher	5.543.385
Crusher Motor	225.200
Conveyor	1.259.140
Sub total	23.541.027
Tertiary	
Screen	0
Screen Motor	0
Tertiary Crusher	5.609.378
Tertiary Crusher Motor	613.732
Conveyor	5.179.105
Sub total	11.402.215
Screening	
Screen	493.625
Screen	316.765
Screen	316.765
Screen Motor	61.829
Conveyor	6.905.474
Sub total	8.094.457
Buildings	
Shop	90.500
Dry	150.900
Office	322.000
Warehouse	72.400
Storage Bins	784.756
Covered Storage	105.000
Weighbridge	100.000
Plant Building	3.305.000
Sub total	4.930.556
Development	
Access Road	643.250
Railhead	0
Utilities	0
Sub total	643.250
Equipment	
Front-end Loaders	11.033.128
Watertruck	1.187.868
Pick up trucks	400.906
Sub total	12.621.901
Engineering & Management	
	0
Sub total	0
Total Capital	61.569.428

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix G3

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May 2010

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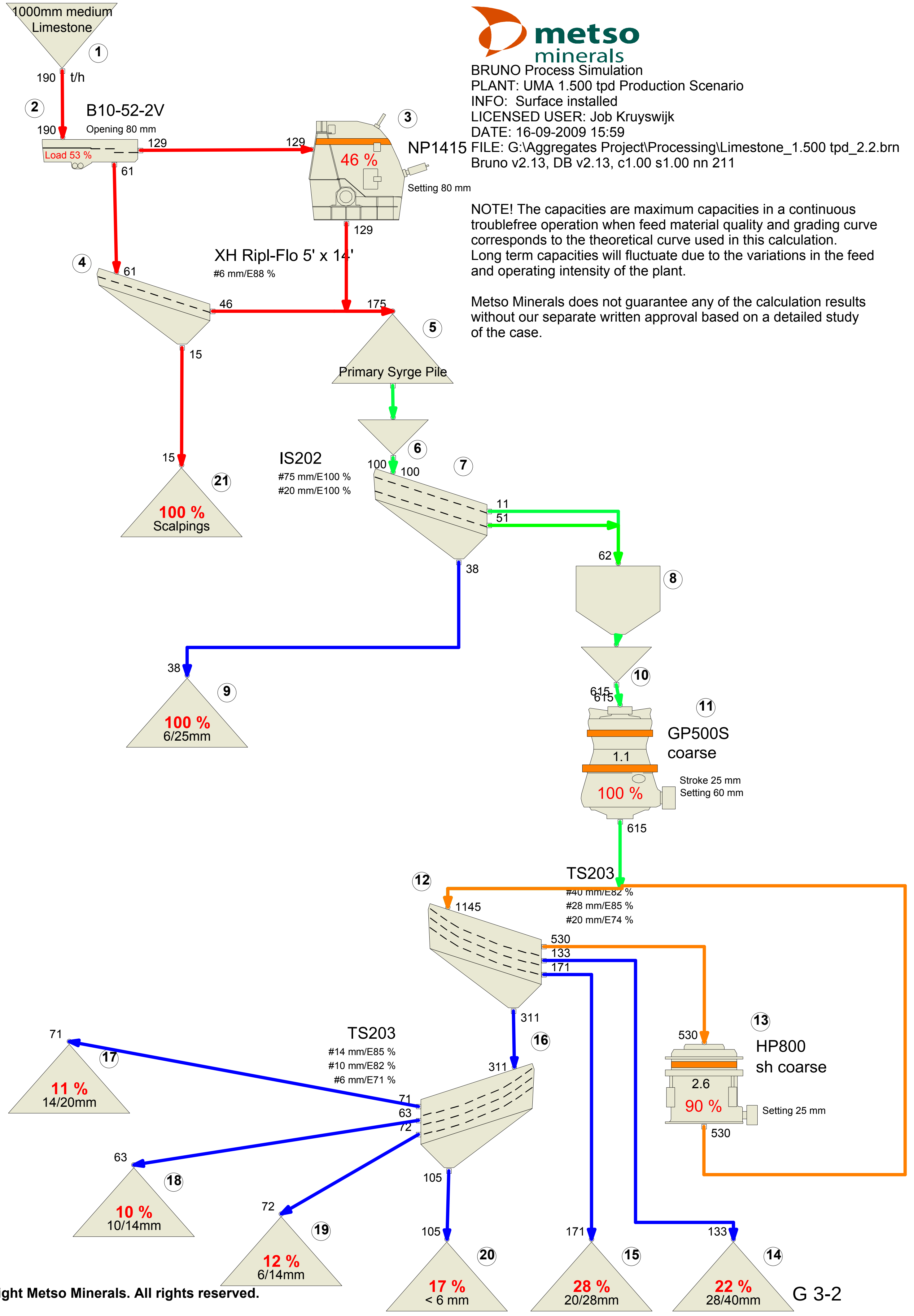
BRUNO Process Simulation
PLANT: UMA 1.500 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 16-09-2009 15:59
FILE: G:\Aggregates Project\Processing\Limestone_1.500 tpd_2.2.brn
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a continuous troublefree operation when feed material quality and grading curve corresponds to the theoretical curve used in this calculation. Long term capacities will fluctuate due to the variations in the feed and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculation results without our separate written approval based on a detailed study of the case.



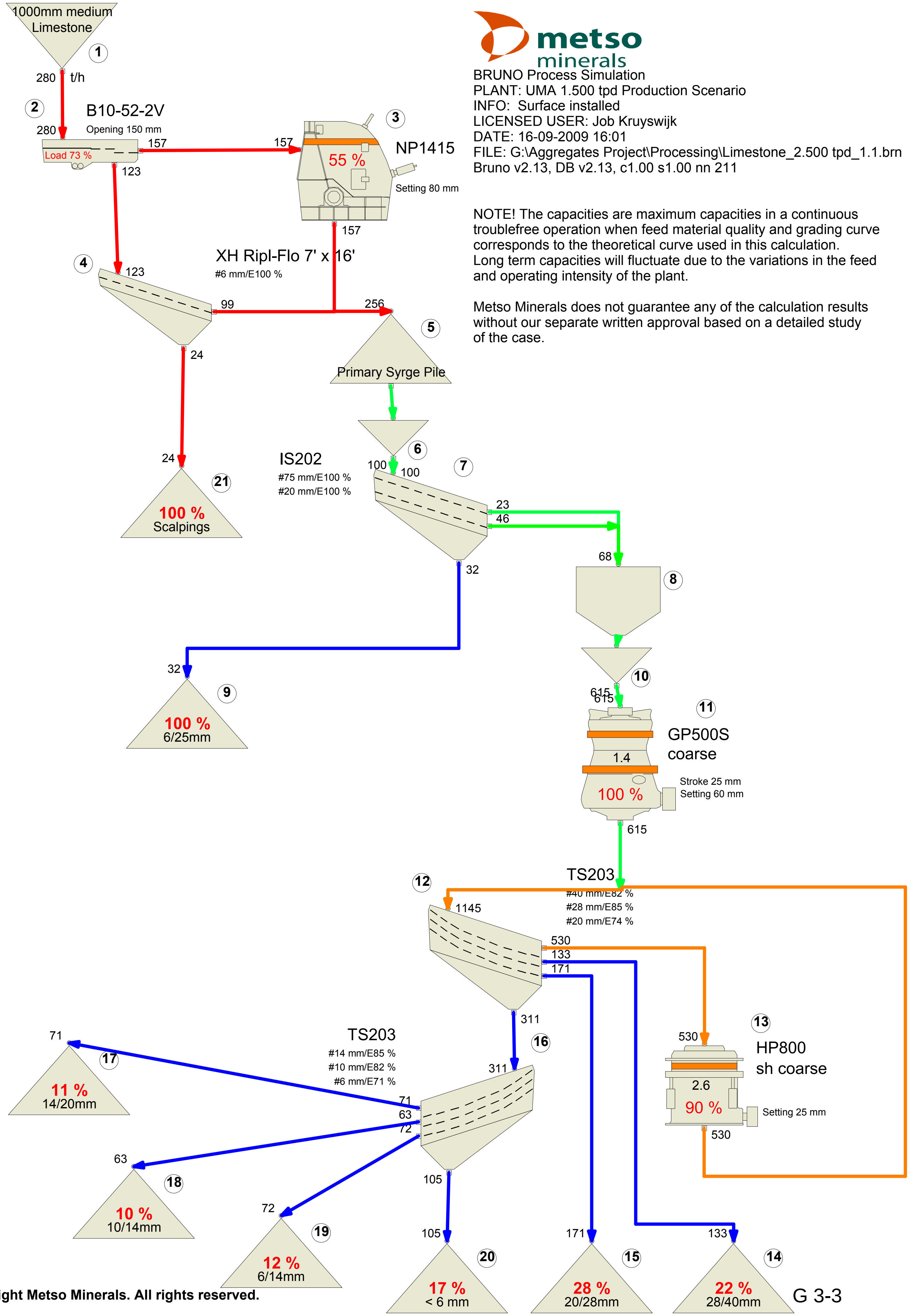
G 3-2

metso minerals

BRUNO Process Simulation
PLANT: UMA 1.500 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 16-09-2009 16:01
FILE: G:\Aggregates Project\Processing\Limestone_2.500 tpd_1.1.brn
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a continuous troublefree operation when feed material quality and grading curve corresponds to the theoretical curve used in this calculation. Long term capacities will fluctuate due to the variations in the feed and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculation results without our separate written approval based on a detailed study of the case.

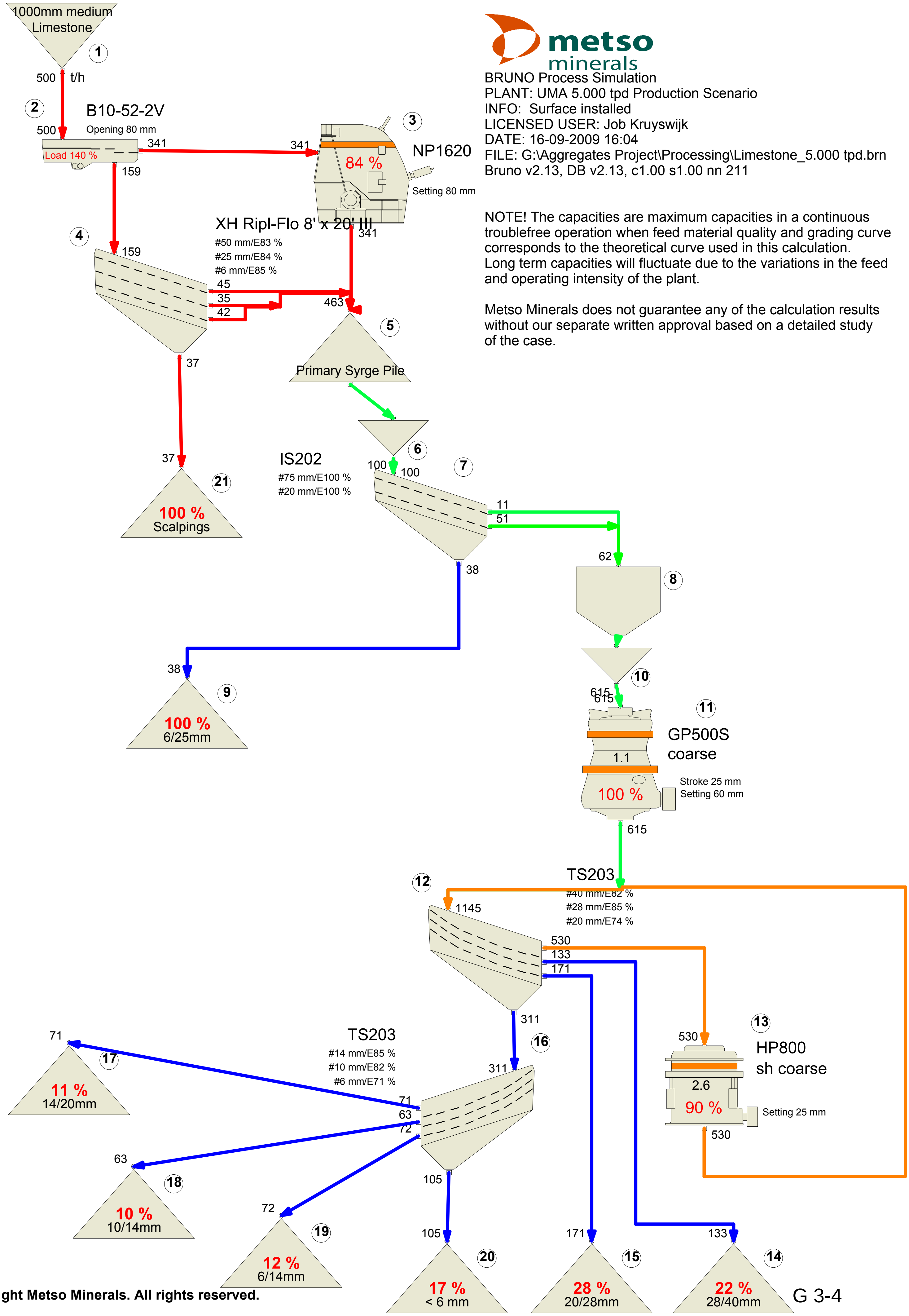


metso minerals

BRUNO Process Simulation
PLANT: UMA 5.000 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 16-09-2009 16:04
FILE: G:\Aggregates Project\Processing\Limestone_5.000 tpd.brn
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a continuous troublefree operation when feed material quality and grading curve corresponds to the theoretical curve used in this calculation. Long term capacities will fluctuate due to the variations in the feed and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculation results without our separate written approval based on a detailed study of the case.



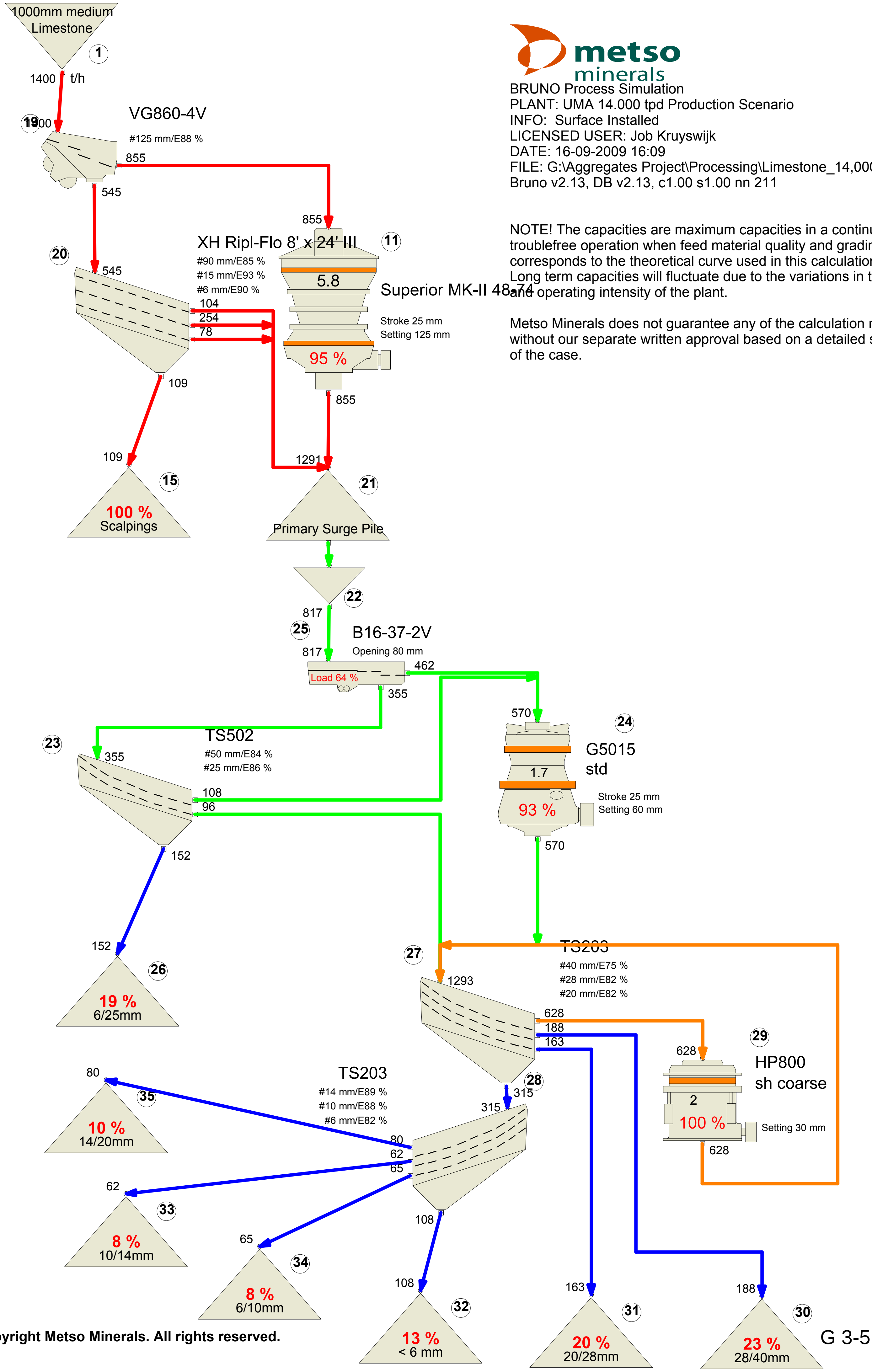
G 3-4

metso minerals

BRUNO Process Simulation
PLANT: UMA 14.000 tpd Production Scenario
INFO: Surface Installed
LICENSED USER: Job Kruyswijk
DATE: 16-09-2009 16:09
FILE: G:\Aggregates Project\Processing\Limestone_14,000 tpd 1,2.brn
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a continuous troublefree operation when feed material quality and grading curve corresponds to the theoretical curve used in this calculation. Long term capacities will fluctuate due to the variations in the feed and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculation results without our separate written approval based on a detailed study of the case.



G 3-5

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix G4

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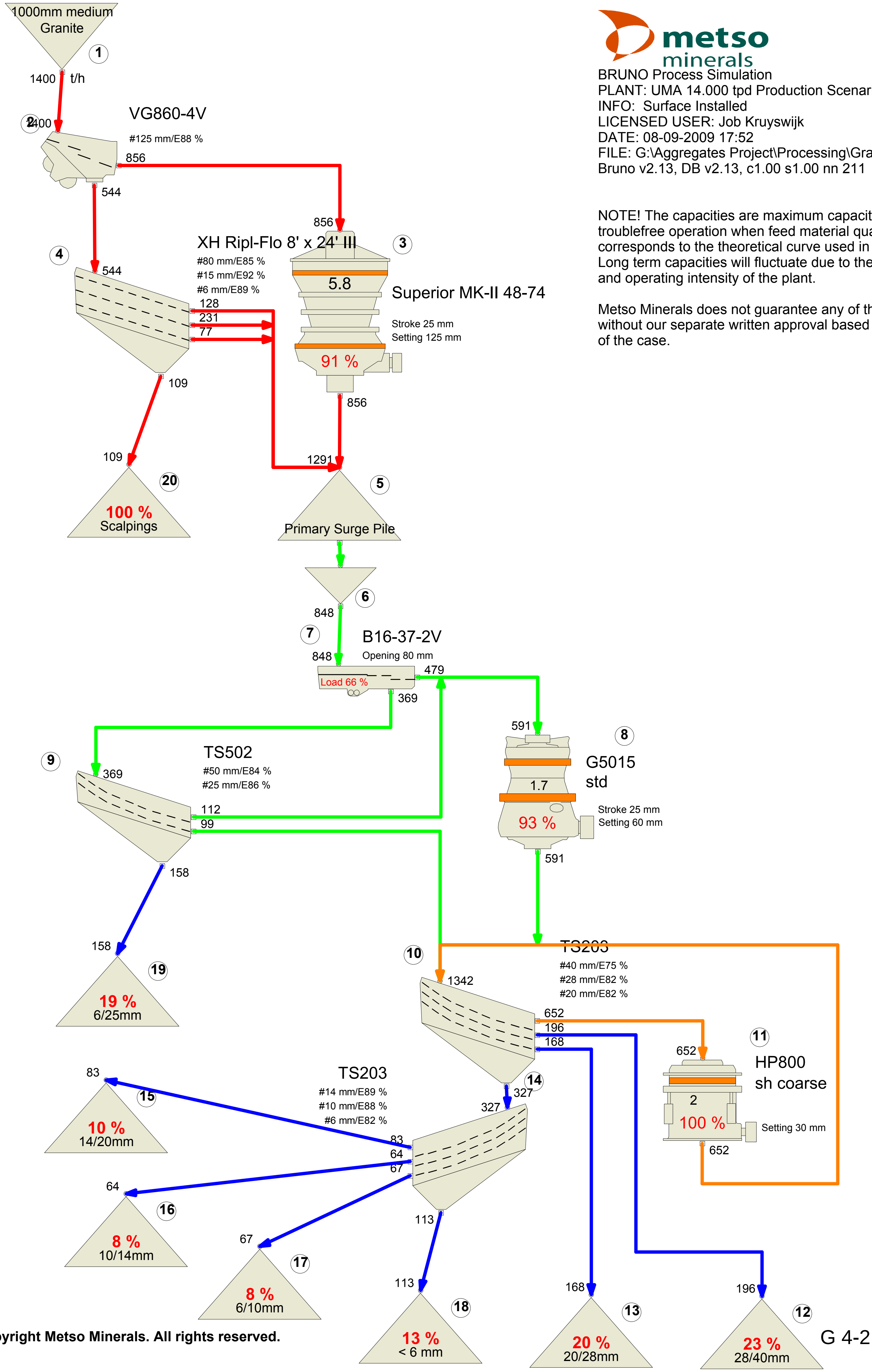
May 2010

BRUNO Process Simulation
PLANT: UMA 14.000 tpd Production Scenario
INFO: Surface Installed
LICENSED USER: Job Kruyswijk
DATE: 08-09-2009 17:52
FILE: G:\Aggregates Project\Processing\Granite_14,000 tp
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a continu troublefree operation when feed material quality and gradir corresponds to the theoretical curve used in this calculatio Long term capacities will fluctuate due to the variations in t and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculation r without our separate written approval based on a detailed s of the case.

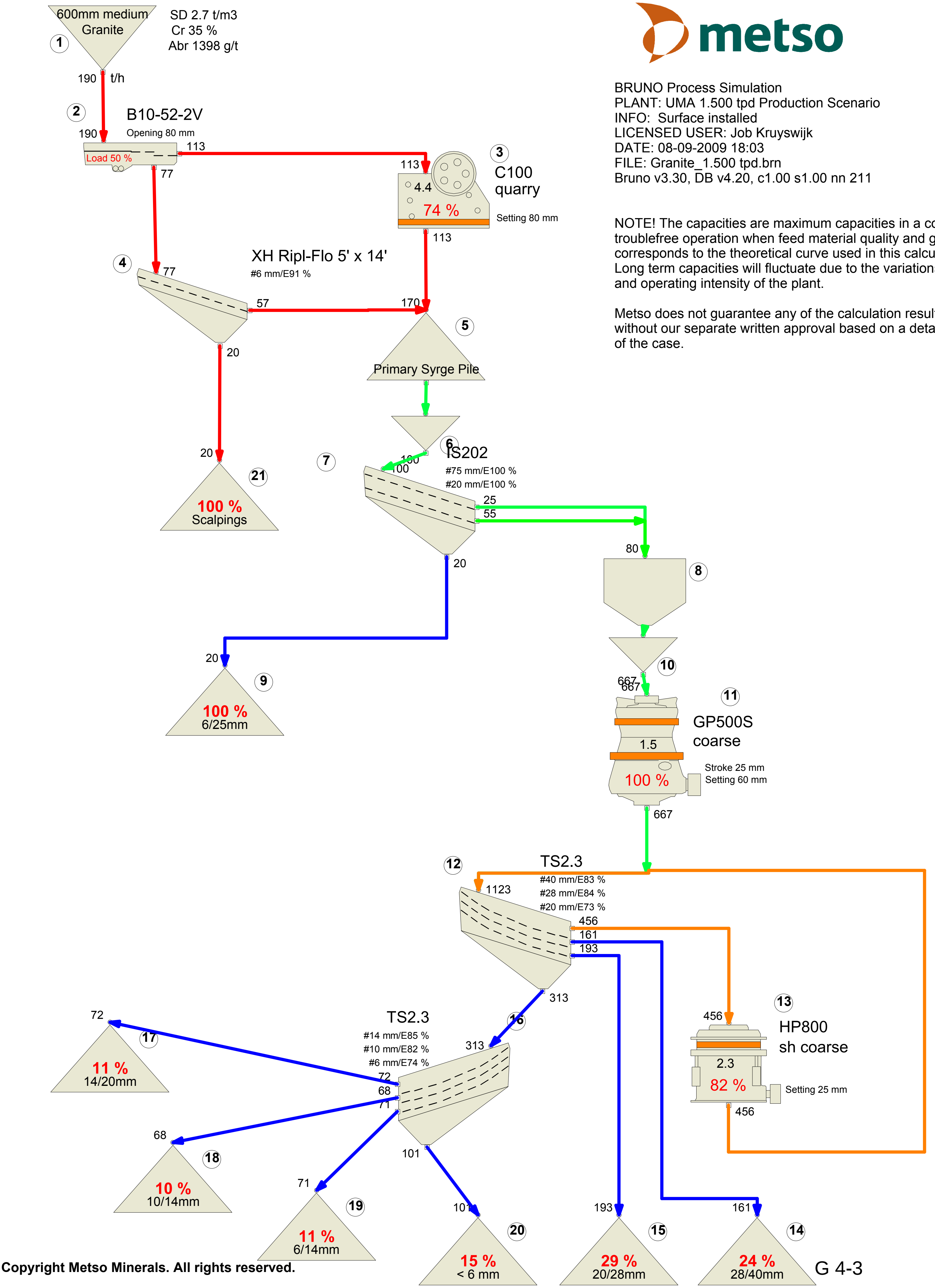


G 4-2

BRUNO Process Simulation
PLANT: UMA 1.500 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 08-09-2009 18:03
FILE: Granite_1.500 tpd.brn
Bruno v3.30, DB v4.20, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a cont
troublefree operation when feed material quality and gra
corresponds to the theoretical curve used in this calculat
Long term capacities will fluctuate due to the variations i
and operating intensity of the plant.

Metso does not guarantee any of the calculation results
without our separate written approval based on a detaile
of the case.



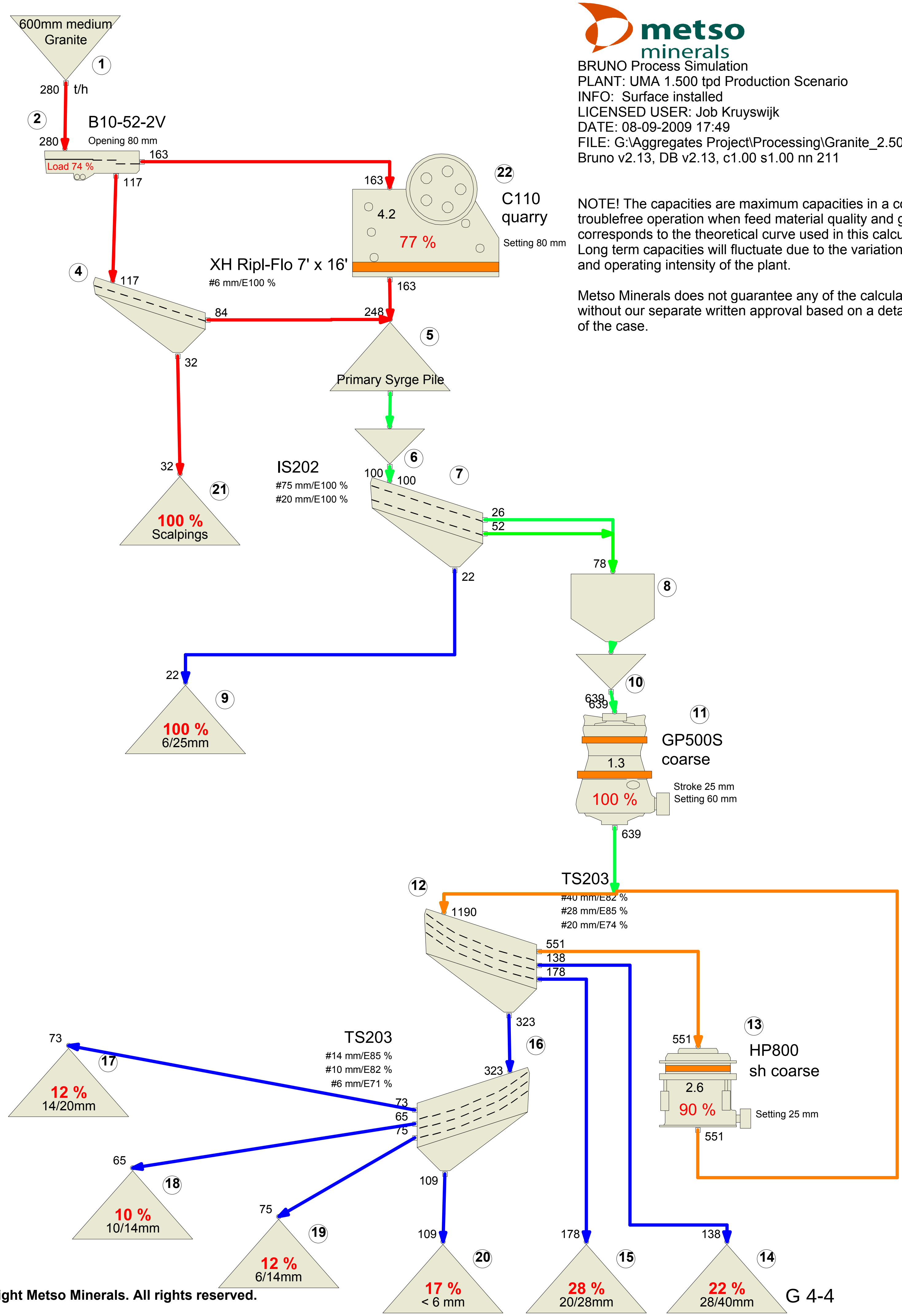
G 4-3

metso minerals

BRUNO Process Simulation
PLANT: UMA 1.500 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 08-09-2009 17:49
FILE: G:\Aggregates Project\Processing\Granite_2.500 tp
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a conti
troublefree operation when feed material quality and grad
corresponds to the theoretical curve used in this calculati
Long term capacities will fluctuate due to the variations in
and operating intensity of the plant.

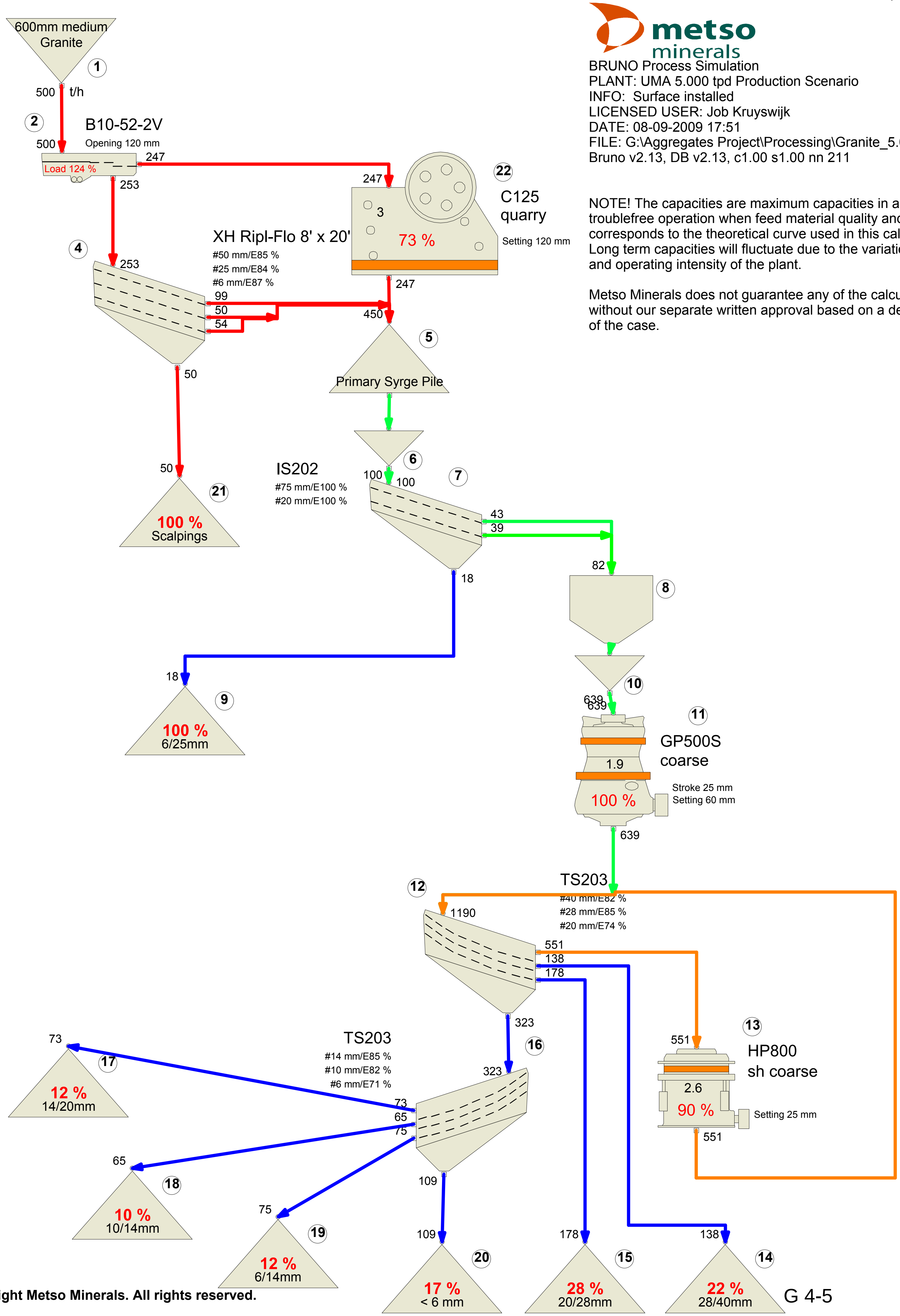
Metso Minerals does not guarantee any of the calculation
without our separate written approval based on a detailed
of the case.



BRUNO Process Simulation
PLANT: UMA 5.000 tpd Production Scenario
INFO: Surface installed
LICENSED USER: Job Kruyswijk
DATE: 08-09-2009 17:51
FILE: G:\Aggregates Project\Processing\Granite_5.000
Bruno v2.13, DB v2.13, c1.00 s1.00 nn 211

NOTE! The capacities are maximum capacities in a co
troublefree operation when feed material quality and gr
corresponds to the theoretical curve used in this calcula
Long term capacities will fluctuate due to the variations
and operating intensity of the plant.

Metso Minerals does not guarantee any of the calculati
without our separate written approval based on a detail
of the case.



G 4-5

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix H1

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May 2010

Quarry		**Daily Production**											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Characteristics	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Daily production rate	tonnes	1.500	1.500	1.500	2.500	2.500	2.500	5.000	5.000	5.000	14.000	14.000	14.000
Hourly production rate	tonnes	188	188	188	278	278	278	500	500	500	1.400	1.400	1.400
Annual production	kT	375	375	375	625	625	625	1.250	1.250	1.250	3.500	3.500	3.500
Shifts per day:		1	1	1	1	1	1	1	1	1	1	1	1
Workinghours / shift:	hours	8	8	8	9	9	9	10	10	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20	20	20	20	20
Mineable reserve	MT	7,5	7,5	7,5	12,5	12,5	12,5	25,0	25,0	25,0	70,0	70,0	70,0
Drill and Blast Specifications													
Bench height (stone)	metre	15	15	15	15	15	15	15	15	15	15	15	15
Blast size:	tonnes	10.000	10.000	10.000	12.000	12.000	12.000	12.000	12.000	12.000	15.000	15.000	15.000
Powder factor:	kg/tonne	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Drill factor:	m/tonne	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Blasthole diameter	metres	0,115	0,115	0,115	0,115	0,115	0,115	0,125	0,125	0,125	0,125	0,125	0,125
Blasthole spacing	metres	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Blasthole burden	metres	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Insitu rock density	kg/m^3	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650
Rows per blast	No.	2	2	2	2	2	2	2	2	2	3	3	3
Production faces	No.	1	1	1	1	1	1	2	2	2	2	2	2
Powder density	kg/m^3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Drill bit life	metres	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Pre-Production Development													
Ultimate Pit Area	hectare	25	25	25	50	50	50	100	100	100	100	100	100
Pre Strip Area	hectare	12,5	12,5	12,5	25,0	25,0	25,0	50,0	50,0	50,0	50,0	50,0	50,0
Pre Strip Depth	metres	0	1,5	3	0	1,5	3	0	1,5	3	0	1,5	3
Pre-Strip Volume	m^3	0	187.500	375.000	0	375.000	750.000	0	750.000	1.500.000	0	750.000	1.500.000
Preproduction Mass	tonnes	0	375.000	750.000	0	750.000	1.500.000	0	1.500.000	3.000.000	0	1.500.000	3.000.000
Initial Haul Roads	meter	282	282	282	399	399	399	564	564	564	564	564	564

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Initial Equipment	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	n°							1	1	1	2	2	2
	type							E0168	E0168	E0168	E0170	E0170	E0170
Front-end Loaders	n°	1	1	1	1	1	1	2	2	2	1	1	1
	type	E0133	E0133	E0133	E0133	E0133	E0133	E0134	E0134	E0134	E0134	E0134	E0134
Rear-dump Trucks	n°	2	2	2	4	5	5	6	6	6	7	7	7
	type	E0259	E0259	E0259	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261
Percussion Drills	n°	1	1	1	1	1	1	2	2	2	2	2	2
	mm	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077
Bulldozers	n°		1	1		1	1		1	1		1	1
	type		E0188	E0188		E0188	E0188		E0188	E0188		E0188	E0188
Graders	n°			1			1	1	1	1	1	1	1
	type			E0094			E0094	E0094	E0094	E0094	E0094	E0094	E0094
Hydraulic Shovels	n°		1	1		1	1		1	1		1	1
(strippping)	type		E0007	E0007		E0007	E0007		E0009	E0009		E0009	E0009
Articulated Trucks	n°		1	1		1	2		1	2		1	2
(strippping)	type		E0247	E0247		E0247	E0247		E0247	E0247		E0251	E0251
Water Tankers	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239
Service/Tyre Trucks	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234
Powder Truck	n°				1	1	1	1	1	1	1	1	1
	type				E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238
Primary Crusher	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	P0224	P0224	P0224	P0224	P0224	P0224	P0226	P0226	P0226	P0226	P0226	P0226
Primary Crusher Motor	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	BU0229	BU0229	BU0229	BU0229	BU0229	BU0229	BU0230	BU0230	BU0230	BU0230	BU0230	BU0230
Light Plants	n°												
	type												
Pumps	n°				2	2	2	2	2	2	2	2	2
	type				P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006
Pickup Trucks	n°	2	2	2	3	3	3	4	4	4	7	7	7
	type	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Buildings	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	199	199	199	288	288	288	486	486	486	486	486	486
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	168	168	168	250	250	250	221	221	221	221	221	221
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	100	100	100	125	125	125	160	160	160	160	160	160
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	149	149	149	194	194	194	297	297	297	297	297	297
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2				11	11	11	20	20	20	20	20	20
	type				B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Primary Crusher House	no	1	1	1	1	1	1	1	1	1	1	1	1
	type	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042
Consumables													
Diesel Fuel	liter/day	1540	2086	2215	2886	3879	4144	6421	7166	7299	7524	8287	8439
Electricity	kWh/day	2228	2228	2228	2707	2707	2707	3008	3008	3008	5793	5793	5793
Explosives	kg/day	224	224	224	376	376	376	752	752	752	2100	2100	2100
Caps	#/day	5	5	5	7	7	7	13	13	13	30	30	30
Primers	#/day	9	9	9	13	13	13	27	27	27	60	60	60
Drill Bits	#/day	0,04	0,04	0,04	0,07	0,07	0,07	0,13	0,13	0,13	0,37	0,37	0,37
Det. Cord	m/day	45	45	45	63	63	63	125	125	125	280	280	280
Personal - Hourly Rate													
Drillers	no				1	1	1	2	2	2	2	2	2
Blasters	no				1	1	1	1	1	1	1	1	1
Excavator Operators	no		1	1		1	1	1	2	2	2	3	3
Truck Drivers	no	2	3	3	4	6	7	6	7	8	7	8	9
Equipment Operators	no	2	2	2	1	1	1	2	2	2	1	1	1
Utility Operators	no				1	1	1	1	1	1	1	1	1
Mechanics	no	2	2	2	3	4	4	6	7	7	8	9	9
Labourers/Maintenance	no	1	1	1	1	1	1	2	2	2	4	4	4
Drillers	type	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001
Blasters	type	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002
Excavator Operators	type	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003
Truck Drivers	type	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004
Equipment Operators	type	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005
Utility Operators	type	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006
Mechanics	type	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007
Labourers/Maintenance	type	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008
Personel - Salaried													
Manager	no	1	1	1	1	1	1	1	1	1	1	1	1
Superintendent	no												
Foreman	no									1	2	2	2
Engineer	no												
Geologist	no												
Supervisor	no												
Technician	no												
Accountant	no												
Clerk	no	1	1	1	2	2	2	3	3	3	7	7	7
Personnel	no												
Secretary	no												
Security	no												
Manager	no	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	no	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	no	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	no	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	no	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	no	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	no	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	no	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	no	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	no	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	no	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	no	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		9	11	11	15	19	20	25	28	30	36	39	40

CAPEX		Items			Item Price			Total Cost			Equipment Life		
Quarry 1,500 tpd					GB£	GB£	GB£	GB£	GB£	GB£	(Years)		
Equipment		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Front-end Loaders	no	1	1	1	432.618	432.618	432.618	432.618	432.618	432.618	9	9	9
	type	E0133	E0133	E0133									
Rear-dump Trucks	no	2	2	2	344.514	344.514	344.514	689.027	689.027	689.027	18	18	18
	type	E0259	E0259	E0259									
Percussion Drills	no	1	1	1	333.939	333.939	333.939	333.939	333.939	333.939	9	9	9
	type	E0077	E0077	E0077									
Bulldozers	no	0	1	1	0	217.060	217.060	0	217.060	217.060	0	7	7
	type	0	E0188	E0188									
Graders	no	0	0	1	0	0	150.272	0	0	150.272	0	0	7
	type	0	0	E0094									
Hydraulic Shovels	no	0	1	1	0	413.528	413.528	0	413.528	413.528	0	7	7
(strippping)	type	0	E0007	E0007									
Articulated Trucks	no	0	1	1	0	176.431	176.431	0	176.431	176.431	0	18	18
(strippping)	type	0	E0247	E0247									
Water Tankers	no	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	18	18	18
	type	E0239	E0239	E0239									
Service/Tire Trucks	no	1	1	1	65.675	65.675	65.675	65.675	65.675	65.675	18	18	18
	type	E0234	E0234	E0234									
Powder Buggies	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Primary Crusher	no	1	1	1	273.830	273.830	273.830	273.830	273.830	273.830	26	26	26
	type	P0224	P0224	P0224									
Primary Crusher Motor	no	1	1	1	26.492	26.492	26.492	26.492	26.492	26.492	11	11	11
	type	BU0229	BU0229	BU0229									
Light Plants	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Pumps	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Pickup Trucks	no	2	2	2	15.027	15.027	15.027	30.054	30.054	30.054	18	18	18
	type	E0224	E0224	E0224									
								1.985.211	**2.792.230**	**2.942.502**			

CAPEX		Items			Item Price			Total Cost			Equipment Life		
Quarry 1,500 tpd					GB£	GB£	GB£	GB£	GB£	GB£	(Years)		
Buildings		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	199	199	199	362	362	362	72.038	72.038	72.038	20	20	20
	type	B0081	B0081	B0081									
Changehouse	m2	168	168	168	1.509	1.509	1.509	253.512	253.512	253.512	20	20	20
	type	B0087	B0087	B0087									
Office	m2	100	100	100	644	644	644	64.400	64.400	64.400	20	20	20
	type	B0086	B0086	B0086									
Stores	m2	149	149	149	362	362	362	53.938	53.938	53.938	20	20	20
	type	B0081	B0081	B0081									
Powder Magazine	m2	0	0	0	0	0	0	0	0	0			
	type	0	0	0									
Primary Crusher House	no	1	1	1	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	20	20	20
	type	B0042	B0042	B0042									
					Sub Total:			**1.443.888**	**1.443.888**	**1.443.888**			
Working Capital													
25% of OPEX								193.567	243.917	252.486			
					Sub Total:			**193.567**	**243.917**	**252.486**			
Engineering & Management													
								200.000	300.000	350.000			
					Sub Total:			**200.000**	**300.000**	**350.000**			
Contingency													
					Sub Total:			**0**	**0**	**0**			
Haul Roads/Site Work													
site clearing													
					Sub Total:			**0**	**0**	**0**			

Total Capital: Incl. Equipment	**3.822.666**	**4.780.035**	**4.988.877**	**GB£**

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 1,500 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Equipment		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Hydraulic Shovels	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Front-end Loaders	no	1	1	1	16,92	16,92	16,92	12.944	12.944	12.944	507	507	507	15.143	15.143	15.143
	type	E0133	E0133	E0133							382	382	382			
Rear-dump Trucks	no	2	2	2	8,99	8,99	8,99	10.847	10.847	10.847	745	745	745	19.014	19.014	19.014
	type	E0259	E0259	E0259							497	497	497			
Percussion Drills	no	1	1	1	17,30	17,30	17,30	0	0	0	703	703	703	28.715	28.715	28.715
	type	E0077	E0077	E0077							409	409	409			
Bulldozers	no	0	1	1	0,00	10,07	10,07	0	0	0	0	418	418	0	16.723	16.723
	type	0	E0188	E0188							0	173	173			
Graders	no	0	0	1	0,00	0,00	4,80	0	0	517	0	0	152	0	0	7.456
	type	0	0	E0094							0	0	129			
Hydraulic Shovels	no	0	1	1	0,00	12,96	12,96	0	0	0	0	419	419	0	21.518	21.518
(strippping)	type	0	E0007	E0007							0	267	267			
Articulated Trucks	no	0	1	1	0,00	4,84	4,84	0	2.901	2.901	0	115	115	0	5.137	5.137
(strippping)	type	0	E0247	E0247							0	107	107			
Water Tankers	no	1	1	1	5,11	5,11	5,11	1.718	1.718	1.718	200	200	200	6.763	6.763	6.763
	type	E0239	E0239	E0239							150	150	150			
Service/Tire Trucks	no	1	1	1	1,96	1,96	1,96	277	277	277	67	67	67	2.984	2.984	2.984
	type	E0234	E0234	E0234							64	64	64			
Powder Buggies	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Primary Crusher	no	1	1	1	17,32	17,32	17,32	0	0	0	1.205	1.205	1.205	28.752	28.752	28.752
	type	P0224	P0224	P0224							0	0	0			
Primary Crusher Motor	no	1	1	1	0,74	0,74	0,74	0	0	0	115	115	115	1.229	1.229	1.229
	type	BU0229	BU0229	BU0229							3.714	3.714	3.714			
Light Plants	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Pumps	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Pickup Trucks	no	2	2	2	0,57	0,57	0,57	92	92	92	1.614	1.614	1.614	1.811	1.811	1.811
	type	E0224	E0224	E0224							38	38	38			
								25.878	28.779	29.297						
													Sub Total:	104.410	147.787	155.242

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 1,500 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Buildings		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Workshop	m2	199	199	199	3,62	3,62	3,62							720	720	720
	type	B0081	B0081	B0081												
Changehouse	m2	168	168	168	15,09	15,09	15,09							2.535	2.535	2.535
	type	B0087	B0087	B0087												
Office	m2	100	100	100	6,44	6,44	6,44							644	644	644
	type	B0086	B0086	B0086												
Stores	m2	149	149	149	3,62	3,62	3,62							539	539	539
	type	B0081	B0081	B0081												
Powder Magazine	m2	0	0	0	0,00	0,00	0,00							0	0	0
	type	0	0	0												
Primary Crusher House	no	1	1	1	5.000,00	5.000,00	5.000,00							5.000	5.000	5.000
	type	B0042	B0042	B0042												
													Sub Total:	9.439	9.439	9.439
Consumables																
Diesel Fuel	liter/day	1.540	2.086	2.215	0,76	0,76	0,76				1.540	2.086	2.215	292.534	396.351	420.844
	type	C0001	C0001	C0001												
Electricity	kWh/day	2.228	2.228	2.228	0,08	0,08	0,08				3.714	3.714	3.714	43.449	43.449	43.449
	type	C0002	C0002	C0002							**2.228**	**2.228**	**2.228**			
Explosives	kg/day	224	224	224	0,50	0,50	0,50							28.000	28.000	28.000
	type	C0003	C0003	C0003												
Caps	#/day	5	5	5	1,50	1,50	1,50							1.688	1.688	1.688
	type	C0004	C0004	C0004												
Primers	#/day	9	9	9	2,30	2,30	2,30							5.175	5.175	5.175
	type	C0005	C0005	C0005												
Drill Bits	#/day	0	0	0	906,64	906,64	906,64							8.704	8.704	8.704
	type	C0055	C0055	C0055												
Det. Cord	m/day	45	45	45	0,25	0,25	0,25							2.813	2.813	2.813
	type	C0006	C0006	C0006												
Tyres	GB£/year	1	1	1	25.878	28.779	29.297							25.878	28.779	29.297
													Sub Total:	408.240	514.958	539.968
Personal Hourly Rate																
Drillers	no	0	0	0	11,88	11,88	11,88							0	0	0
Blasters	no	0	0	0	11,88	11,88	11,88							0	0	0
Excavator Operators	no	0	1	1	10,00	10,00	10,00							0	20.000	20.000
Truck Drivers	no	2	3	3	10,00	10,00	10,00							40.000	60.000	60.000
Equipment Operators	no	2	2	2	9,38	9,38	9,38							37.500	37.500	37.500
Utility Operators	no	0	0	0	11,88	11,88	11,88							0	0	0
Mechanics	no	2	2	2	11,88	11,88	11,88				3.836	4.788	4.941	45.554	56.861	58.671
Laborers/Maintenance	no	1	1	1	8,75	8,75	8,75							17.500	17.500	17.500
Personel Fixed Wages																
Manager	no	1	1	1	84.000,00	84.000,00	84.000,00							84.000	84.000	84.000
Superintendent	no	0	0	0	70.000	70.000,00	70.000,00							0	0	0
Foreman	no	0	0	0	75.000	75.000,00	75.000,00							0	0	0
Engineer	no	0	0	0	52.000	52.000,00	52.000,00							0	0	0
Geologist	no	0	0	0	52.000	52.000,00	52.000,00							0	0	0
Supervisor	no	0	0	0	39.000	39.000,00	39.000,00							0	0	0
Technician	no	0	0	0	52.000	52.000,00	52.000,00							0	0	0
Accountant	no	0	0	0	70.000	70.000,00	70.000,00							0	0	0
Clerk	no	1	1	1	27.500	27.500,00	27.500,00							27.500	27.500	27.500
Personnel	no	0	0	0	37.500	37.500,00	37.500,00							0	0	0
Secretary	no	0	0	0	27.500	27.500,00	27.500,00							0	0	0
Security	no	0	0	0	25.000	25.000,00	25.000,00							0	0	0
													Sub Total:	252.054	303.361	305.171

Total Operational: Incl. Equipment	774.142	975.545	1.009.821	GB£

Quarry 1.500 tpd, No Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	0	432.618	0	
Rear-dump Trucks		689.027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.027	0	
Percussion Drills		333.939	0	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	0	333.939	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydraulic Shovels (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Articulated Trucks (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	
Powder Buggies		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pickup Trucks		30.054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.054	0	
Sub total		**1.985.211**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**0**	**0**	**0**	**0**	**1.684.888**	**0**	**0**
Buildings																					
Workshop		72.038																			
Changehouse		253.512																			
Office		64.400																			
Stores		53.938																			
Powder Magazine		0																			
Primary Crusher House		1.000.000																			
Sub total		**1.443.888**																			
Engineering & Management																					
	200.000																				
Sub total	**200.000**																				
Total Capital	**200.000**	**3.429.099**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**0**	**0**	**0**	**0**	**1.684.888**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	1.378.054
Percussion Drills	1.001.817
Bulldozers	0
Graders	0
Hydraulic Shovels (strippping)	0
Articulated Trucks (strippping)	0
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	0
Primary Crusher	273.830
Primary Crusher Motor	52.985
Light Plants	0
Pumps	0
Pickup Trucks	60.109
Sub Total:	4.463.148
	72.038
	253.512
	64.400
	53.938
	0
	1.000.000
Sub Total:	1.443.888
	200.000
Sub Total:	200.000
Grand Total	6.107.036

Quarry 1.500 tpd, 1,5 m Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	0	432.618	0	
Rear-dump Trucks		689.027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.027	0	
Percussion Drills		333.939	0	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	0	333.939	0	
Bulldozers		217.060	0	0	0	0	0	217.060	0	0	0	0	0	0	217.060	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydraulic Shovels		413.528	0	0	0	0	0	413.528	0	0	0	0	0	0	413.528	0	0	0	0	0	
(strippping)		0																			
Articulated Trucks		176.431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176.431	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	
Powder Buggies		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pickup Trucks		30.054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.054	0	
Sub total		**2.792.230**	**0**	**0**	**0**	**0**	**0**	**630.588**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**630.588**	**0**	**0**	**0**	**1.861.319**	**0**	**0**
Buildings																					
Workshop		72.038																			
Changehouse		253.512																			
Office		64.400																			
Stores		53.938																			
Powder Magazine		0																			
Primary Crusher House		1.000.000																			
Sub total		**1.443.888**																			
Engineering & Management																					
	300.000																				
Sub total	**300.000**																				
Total Capital	**300.000**	**4.236.118**	**0**	**0**	**0**	**0**	**0**	**630.588**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**630.588**	**0**	**0**	**0**	**1.861.319**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	1.378.054
Percussion Drills	1.001.817
Bulldozers	651.181
Graders	0
Hydraulic Shovels (strippping)	1.240.583
Articulated Trucks (strippping)	352.862
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	0
Primary Crusher	273.830
Primary Crusher Motor	52.985
Light Plants	0
Pumps	0
Pickup Trucks	60.109
Sub Total:	6.707.774
	72.038
	253.512
	64.400
	53.938
	0
	1.000.000
Sub Total:	1.443.888
	300.000
Sub Total:	300.000
Grand Total	8.451.662

Quarry 1.500 tpd, 3 m Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	0	432.618	0	
Rear-dump Trucks		689.027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.027	0	
Percussion Drills		333.939	0	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	0	333.939	0	
Bulldozers		217.060	0	0	0	0	0	217.060	0	0	0	0	0	0	217.060	0	0	0	0	0	
Graders		150.272	0	0	0	0	0	150.272	0	0	0	0	0	0	150.272	0	0	0	0	0	
Hydraulic Shovels		413.528	0	0	0	0	0	413.528	0	0	0	0	0	0	413.528	0	0	0	0	0	
(strippping)		0																			
Articulated Trucks		176.431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176.431	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	
Powder Buggies		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pickup Trucks		30.054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.054	0	
Sub total		**2.942.502**	**0**	**0**	**0**	**0**	**0**	**780.860**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**780.860**	**0**	**0**	**0**	**1.861.319**	**0**	**0**
Buildings																					
Workshop		72.038																			
Changehouse		253.512																			
Office		64.400																			
Stores		53.938																			
Powder Magazine		0																			
Primary Crusher House		1.000.000																			
Sub total		**1.443.888**																			
Engineering & Management																					
	350.000																				
Sub total	**350.000**																				
Total Capital	**350.000**	**4.386.390**	**0**	**0**	**0**	**0**	**0**	**780.860**	**0**	**766.557**	**0**	**26.492**	**0**	**0**	**780.860**	**0**	**0**	**0**	**1.861.319**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	1.378.054
Percussion Drills	1.001.817
Bulldozers	651.181
Graders	450.817
Hydraulic Shovels	1.240.583
(strippping)	
Articulated Trucks	352.862
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	0
Primary Crusher	273.830
Primary Crusher Motor	52.985
Light Plants	0
Pumps	0
Pickup Trucks	60.109
Sub Total:	7.158.591
	72.038
	253.512
	64.400
	53.938
	0
	1.000.000
Sub Total:	1.443.888
	350.000
Sub Total:	350.000
Grand Total	8.952.479

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix H2

May 2010

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Characteristics	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Daily production rate	tonnes	1.500	1.500	1.500	2.500	2.500	2.500	5.000	5.000	5.000	14.000	14.000	14.000
Hourly production rate	tonnes	188	188	188	278	278	278	500	500	500	1.400	1.400	1.400
Annual production	kT	375	375	375	625	625	625	1.250	1.250	1.250	3.500	3.500	3.500
Shifts per day:		1	1	1	1	1	1	1	1	1	1	1	1
Workinghours / shift:	hours	8	8	8	9	9	9	10	10	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20	20	20	20	20
Mineable reserve	MT	7,5	7,5	7,5	12,5	12,5	12,5	25,0	25,0	25,0	70,0	70,0	70,0
Drill and Blast Specifications													
Bench height (stone)	metre	15	15	15	15	15	15	15	15	15	15	15	15
Blast size:	tonnes	10.000	10.000	10.000	12.000	12.000	12.000	12.000	12.000	12.000	15.000	15.000	15.000
Powder factor:	kg/tonne	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Drill factor:	m/tonne	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Blasthole diameter	metres	0,115	0,115	0,115	0,115	0,115	0,115	0,125	0,125	0,125	0,125	0,125	0,125
Blasthole spacing	metres	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Blasthole burden	metres	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Insitu rock density	kg/m^3	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650
Rows per blast	No.	2	2	2	2	2	2	2	2	2	3	3	3
Production faces	No.	1	1	1	1	1	1	2	2	2	2	2	2
Powder density	kg/m^3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Drill bit life	metres	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Pre-Production Development													
Ultimate Pit Area	hectare	25	25	25	50	50	50	100	100	100	100	100	100
Pre Strip Area	hectare	12,5	12,5	12,5	25,0	25,0	25,0	50,0	50,0	50,0	50,0	50,0	50,0
Pre Strip Depth	metres	0	1,5	3	0	1,5	3	0	1,5	3	0	1,5	3
Pre-Strip Volume	m^3	0	187.500	375.000	0	375.000	750.000	0	750.000	1.500.000	0	750.000	1.500.000
Preproduction Mass	tonnes	0	375.000	750.000	0	750.000	1.500.000	0	1.500.000	3.000.000	0	1.500.000	3.000.000
Initial Haul Roads	meter	282	282	282	399	399	399	564	564	564	564	564	564

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Initial Equipment	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	n°							1	1	1	2	2	2
	type							E0168	E0168	E0168	E0170	E0170	E0170
Front-end Loaders	n°	1	1	1	1	1	1	2	2	2	1	1	1
	type	E0133	E0133	E0133	E0133	E0133	E0133	E0134	E0134	E0134	E0134	E0134	E0134
Rear-dump Trucks	n°	2	2	2	4	5	5	6	6	6	7	7	7
	type	E0259	E0259	E0259	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261
Percussion Drills	n°	1	1	1	1	1	1	2	2	2	2	2	2
	mm	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077
Bulldozers	n°		1	1		1	1		1	1		1	1
	type		E0188	E0188		E0188	E0188		E0188	E0188		E0188	E0188
Graders	n°			1			1	1	1	1	1	1	1
	type			E0094			E0094	E0094	E0094	E0094	E0094	E0094	E0094
Hydraulic Shovels	n°		1	1		1	1		1	1		1	1
(strippping)	type		E0007	E0007		E0007	E0007		E0009	E0009		E0009	E0009
Articulated Trucks	n°		1	1		1	2		1	2		1	2
(strippping)	type		E0247	E0247		E0247	E0247		E0247	E0247		E0251	E0251
Water Tankers	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239
Service/Tyre Trucks	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234
Powder Truck	n°				1	1	1	1	1	1	1	1	1
	type				E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238
Primary Crusher	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	P0224	P0224	P0224	P0224	P0224	P0224	P0226	P0226	P0226	P0226	P0226	P0226
Primary Crusher Motor	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	BU0229	BU0229	BU0229	BU0229	BU0229	BU0229	BU0230	BU0230	BU0230	BU0230	BU0230	BU0230
Light Plants	n°												
	type												
Pumps	n°				2	2	2	2	2	2	2	2	2
	type				P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006
Pickup Trucks	n°	2	2	2	3	3	3	4	4	4	7	7	7
	type	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Buildings	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	199	199	199	288	288	288	486	486	486	486	486	486
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	168	168	168	250	250	250	221	221	221	221	221	221
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	100	100	100	125	125	125	160	160	160	160	160	160
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	149	149	149	194	194	194	297	297	297	297	297	297
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2				11	11	11	20	20	20	20	20	20
	type				B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Primary Crusher House	no	1	1	1	1	1	1	1	1	1	1	1	1
	type	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042
Consumables													
Diesel Fuel	liter/day	1540	2086	2215	2886	3879	4144	6421	7166	7299	7524	8287	8439
Electricity	kWh/day	2228	2228	2228	2707	2707	2707	3008	3008	3008	5793	5793	5793
Explosives	kg/day	224	224	224	376	376	376	752	752	752	2100	2100	2100
Caps	#/day	5	5	5	7	7	7	13	13	13	30	30	30
Primers	#/day	9	9	9	13	13	13	27	27	27	60	60	60
Drill Bits	#/day	0,04	0,04	0,04	0,07	0,07	0,07	0,13	0,13	0,13	0,37	0,37	0,37
Det. Cord	m/day	45	45	45	63	63	63	125	125	125	280	280	280
Personal - Hourly Rate													
Drillers	no				1	1	1	2	2	2	2	2	2
Blasters	no				1	1	1	1	1	1	1	1	1
Excavator Operators	no		1	1		1	1	1	2	2	2	3	3
Truck Drivers	no	2	3	3	4	6	7	6	7	8	7	8	9
Equipment Operators	no	2	2	2	1	1	1	2	2	2	1	1	1
Utility Operators	no				1	1	1	1	1	1	1	1	1
Mechanics	no	2	2	2	3	4	4	6	7	7	8	9	9
Labourers/Maintenance	no	1	1	1	1	1	1	2	2	2	4	4	4
Drillers	type	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001
Blasters	type	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002
Excavator Operators	type	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003
Truck Drivers	type	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004
Equipment Operators	type	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005
Utility Operators	type	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006
Mechanics	type	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007
Labourers/Maintenance	type	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008
Personel - Salaried													
Manager	no	1	1	1	1	1	1	1	1	1	1	1	1
Superintendent	no												
Foreman	no									1	2	2	2
Engineer	no												
Geologist	no												
Supervisor	no												
Technician	no												
Accountant	no												
Clerk	no	1	1	1	2	2	2	3	3	3	7	7	7
Personnel	no												
Secretary	no												
Security	no												
Manager	no	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	no	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	no	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	no	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	no	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	no	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	no	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	no	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	no	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	no	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	no	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	no	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		9	11	11	15	19	20	25	28	30	36	39	40

CAPEX Quarry 2,500 tpd		Items			Item Price			Total Cost			Equipment Life (Years)		
					GB£	GB£	GB£	GB£	GB£	GB£			
Equipment		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Front-end Loaders	no	1	1	1	432.618	432.618	432.618	432.618	432.618	432.618	8	8	8
	type	E0133	E0133	E0133									
Rear-dump Trucks	no	4	5	5	510.370	510.370	510.370	2.041.480	2.551.849	2.551.849	16	16	16
	type	E0261	E0261	E0261									
Percussion Drills	no	1	1	1	333.939	333.939	333.939	333.939	333.939	333.939	8	8	8
	type	E0077	E0077	E0077									
Bulldozers	no	0	1	1	0	217.060	217.060	0	217.060	217.060	0	6	6
	type	0	E0188	E0188									
Graders	no	0	0	1	0	0	150.272	0	0	150.272	0	0	6
	type	0	0	E0094									
Hydraulic Shovels	no	0	1	1	0	413.528	413.528	0	413.528	413.528	0	6	6
(strippping)	type	0	E0007	E0007									
Articulated Trucks	no	0	1	2	0	176.431	176.431	0	176.431	352.862	0	16	16
(strippping)	type	0	E0247	E0247									
Water Tankers	no	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	16	16	16
	type	E0239	E0239	E0239									
Service/Tire Trucks	no	1	1	1	65.675	65.675	65.675	65.675	65.675	65.675	16	16	16
	type	E0234	E0234	E0234									
Powder Buggies	no	1	1	1	40.073	40.073	40.073	40.073	40.073	40.073	16	16	16
	type	E0238	E0238	E0238									
Primary Crusher	no	1	1	1	273.830	273.830	273.830	273.830	273.830	273.830	23	23	23
	type	P0224	P0224	P0224									
Primary Crusher Motor	no	1	1	1	26.492	26.492	26.492	26.492	26.492	26.492	9	9	9
	type	BU0229	BU0229	BU0229									
Light Plants	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Pumps	no	2	2	2	37.123	37.123	37.123	74.246	74.246	74.246	11	11	11
	type	P0006	P0006	P0006									
Pickup Trucks	no	3	3	3	15.027	15.027	15.027	45.082	45.082	45.082	16	16	16
	type	E0224	E0224	E0224									
								3.467.009	**4.784.398**	**5.111.101**			

CAPEX Quarry 2,500 tpd		Items			Item Price			Total Cost				Equipment Life (Years)		
					GB£	GB£	GB£	GB£	GB£	GB£				
Buildings		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**		**0**	**1,5**	**3**
Workshop	m2	288	288	288	362	362	362	104.256	104.256	104.256		20	20	20
	type	B0081	B0081	B0081										
Changehouse	m2	250	250	250	1.509	1.509	1.509	377.250	377.250	377.250		20	20	20
	type	B0087	B0087	B0087										
Office	m2	125	125	125	644	644	644	80.500	80.500	80.500		20	20	20
	type	B0086	B0086	B0086										
Stores	m2	194	194	194	362	362	362	70.228	70.228	70.228		20	20	20
	type	B0081	B0081	B0081										
Powder Magazine	m2	11	11	11	900	900	900	9.900	9.900	9.900		20	20	20
	type	B0041	B0041	B0041										
Primary Crusher House	no	1	1	1	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000		20	20	20
	type	B0042	B0042	B0042										
					Sub Total:			**1.642.134**	**1.642.134**	**1.642.134**				
Working Capital														
25% of OPEX								345.926	436.337	460.903				
					Sub Total:			**345.926**	**436.337**	**460.903**				
Engineering & Management														
								200.000	300.000	350.000				
					Sub Total:			**200.000**	**300.000**	**350.000**				
Contingency														
					Sub Total:			**0**	**0**	**0**				
Haul Roads/Site Work														
site clearing														
					Sub Total:			**0**	**0**	**0**				
					Total Capital: Incl. Equipment			**5.655.069**	**7.162.868**	**7.564.138**	**GB£**			

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 2,500 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Equipment		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Hydraulic Shovels	no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Front-end Loaders	no	1	1	1	16,92	16,92	16,92	14.562	14.562	14.562	571	571	571	31.597	31.597	31.597
	type	E0133	E0133	E0133							429	429	429			
Rear-dump Trucks	no	4	5	5	12,26	12,26	12,26	28.812	36.015	36.015	2.485	3.106	3.106	91.549	114.436	114.436
	type	E0261	E0261	E0261							1.512	1.890	1.890			
Percussion Drills	no	1	1	1	17,30	17,30	17,30	0	0	0	791	791	791	32.304	32.304	32.304
	type	E0077	E0077	E0077							460	460	460			
Bulldozers	no	0	1	1	0,00	10,07	10,07	0	0	0	0	470	470	0	18.813	18.813
	type	0	E0188	E0188							0	195	195			
Graders	no	0	0	1	0,00	0,00	4,80	0	0	582	0	0	171	0	0	8.970
	type	0	0	E0094							0	0	145			
Hydraulic Shovels	no	0	1	1	0,00	12,96	12,96	0	0	0	0	472	472	0	24.207	24.207
(strippping)	type	0	E0007	E0007							0	300	300			
Articulated Trucks	no	0	1	2	0,00	4,84	4,84	0	3.264	6.527	0	130	259	0	9.043	18.085
(strippping)	type	0	E0247	E0247							0	120	240			
Water Tankers	no	1	1	1	5,11	5,11	5,11	1.933	1.933	1.933	225	225	225	9.542	9.542	9.542
	type	E0239	E0239	E0239							169	169	169			
Service/Tire Trucks	no	1	1	1	1,96	1,96	1,96	312	312	312	75	75	75	3.669	3.669	3.669
	type	E0234	E0234	E0234							72	72	72			
Powder Buggies	no	1	1	1	1,80	1,80	1,80	956	956	956	95	95	95	3.368	3.368	3.368
	type	E0238	E0238	E0238							180	180	180			
Primary Crusher	no	1	1	1	17,32	17,32	17,32	0	0	0	1.356	1.356	1.356	32.346	32.346	32.346
	type	P0224	P0224	P0224							0	0	0			
Primary Crusher Motor	no	1	1	1	0,74	0,74	0,74	0	0	0	130	130	130	1.382	1.382	1.382
	type	BU0229	BU0229	BU0229							4.178	4.178	4.178			
Light Plants	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Pumps	no	2	2	2	0,87	0,87	0,87	0	0	0	293	293	293	3.264	3.264	3.264
	type	P0006	P0006	P0006							334	334	334			
Pickup Trucks	no	3	3	3	0,57	0,57	0,57	156	156	156	2.723	2.723	2.723	3.212	3.212	3.212
	type	E0224	E0224	E0224							64	64	64			
								46.731	57.197	61.043						
													Sub Total:	**212.232**	**287.182**	**305.195**

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 2,500 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Buildings		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Workshop	m2	288	288	288	3,62	3,62	3,62							1.043	1.043	1.043
	type	B0081	B0081	B0081												
Changehouse	m2	250	250	250	15,09	15,09	15,09							3.773	3.773	3.773
	type	B0087	B0087	B0087												
Office	m2	125	125	125	6,44	6,44	6,44							805	805	805
	type	B0086	B0086	B0086												
Stores	m2	194	194	194	3,62	3,62	3,62							702	702	702
	type	B0081	B0081	B0081												
Powder Magazine	m2	11	11	11	9,00	9,00	9,00							99	99	99
	type	B0041	B0041	B0041												
Primary Crusher House	no	1	1	1	5.000,00	5.000,00	5.000,00							5.000	5.000	5.000
	type	B0042	B0042	B0042												
													Sub Total:	**11.421**	**11.421**	**11.421**
Consumables																
Diesel Fuel	liter/day	2.886	3.879	4.144	0,76	0,76	0,76				2.886	3.879	4.144	548.356	736.985	787.319
	type	C0001	C0001	C0001												
Electricity	kWh/day	2.707	2.707	2.707	0,08	0,08	0,08				4.512	4.512	4.512	52.790	52.790	52.790
	type	C0002	C0002	C0002							**2.707**	**2.707**	**2.707**			
Explosives	kg/day	376	376	376	0,50	0,50	0,50							47.000	47.000	47.000
	type	C0003	C0003	C0003												
Caps	#/day	7	7	7	1,50	1,50	1,50							2.500	2.500	2.500
	type	C0004	C0004	C0004												
Primers	#/day	13	13	13	2,30	2,30	2,30							7.667	7.667	7.667
	type	C0005	C0005	C0005												
Drill Bits	#/day	0	0	0	906,64	906,64	906,64							15.111	15.111	15.111
	type	C0055	C0055	C0055												
Det. Cord	m/day	63	63	63	0,25	0,25	0,25							3.906	3.906	3.906
	type	C0006	C0006	C0006												
Tyres	GB£/year	1	1	1	46.731	57.197	61.043							46.731	57.197	61.043
													Sub Total:	**724.061**	**923.157**	**977.336**
Personal Hourly Rate																
Drillers	no	1	1	1	11,88	11,88	11,88							26.719	26.719	26.719
Blasters	no	1	1	1	11,88	11,88	11,88							26.719	26.719	26.719
Excavator Operators	no	0	1	1	10,00	10,00	10,00							0	22.500	22.500
Truck Drivers	no	4	6	7	10,00	10,00	10,00							90.000	135.000	157.500
Equipment Operators	no	1	1	1	9,38	9,38	9,38							21.094	21.094	21.094
Utility Operators	no	1	1	1	11,88	11,88	11,88							26.719	26.719	26.719
Mechanics	no	3	4	4	11,88	11,88	11,88				7.257	8.949	9.250	86.177	106.274	109.848
Laborers/Maintenance	no	1	1	1	8,75	8,75	8,75							19.688	19.688	19.688
Personel Fixed Wages																
Manager	no	1	1	1	84.000	84.000	84.000							84.000	84.000	84.000
Superintendent	no	0	0	0	70.000	70.000	70.000							0	0	0
Foreman	no	0	0	0	75.000	75.000	75.000							0	0	0
Engineer	no	0	0	0	52.000	52.000	52.000							0	0	0
Geologist	no	0	0	0	52.000	52.000	52.000							0	0	0
Supervisor	no	0	0	0	39.000	39.000	39.000							0	0	0
Technician	no	0	0	0	52.000	52.000	52.000							0	0	0
Accountant	no	0	0	0	70.000	70.000	70.000							0	0	0
Clerk	no	2	2	2	27.500	27.500	27.500							55.000	55.000	55.000
Personnel	no	0	0	0	37.500	37.500	37.500							0	0	0
Secretary	no	0	0	0	27.500	27.500	27.500							0	0	0
Security	no	0	0	0	25.000	25.000	25.000							0	0	0
													Sub Total:	**436.115**	**523.711**	**549.786**

Total Operational:	**1.383.829**	**1.745.471**	**1.843.738**	**GB£**
Incl. Equipment				

Quarry 2.500 tpd, No Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	432.618	0	0	0	
Rear-dump Trucks		2.041.480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.041.480	0	0	0	
Percussion Drills		333.939	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	333.939	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydraulic Shovels (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Articulated Trucks (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	26.492	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45.082	0	0	0	
Sub total		**3.467.009**	**0**	**0**	**0**	**0**	**0**	**0**	**766.557**	**26.492**	**0**	**74.246**	**0**	**0**	**0**	**0**	**3.092.441**	**0**	**26.492**	**0**	**0**
Buildings																					
Workshop		104.256																			
Changehouse		377.250																			
Office		80.500																			
Stores		70.228																			
Powder Magazine		9.900																			
Primary Crusher House		1.000.000																			
Sub total		**1.642.134**																			
Engineering & Management																					
	200.000																				
Sub total	**200.000**																				
Total Capital	**200.000**	**5.109.143**	**0**	**0**	**0**	**0**	**0**	**0**	**766.557**	**26.492**	**0**	**74.246**	**0**	**0**	**0**	**0**	**3.092.441**	**0**	**26.492**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	4.082.959
Percussion Drills	1.001.817
Bulldozers	0
Graders	0
Hydraulic Shovels (strippping)	0
Articulated Trucks (strippping)	0
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	273.830
Primary Crusher Motor	79.477
Light Plants	0
Pumps	148.491
Pickup Trucks	90.163
Sub Total:	7.453.237
	104.256
	377.250
	80.500
	70.228
	9.900
	1.000.000
Sub Total:	1.642.134
	200.000
Sub Total:	200.000
Grand Total	9.295.371

Quarry 2.500 tpd, 1,5 m Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	432.618	0	0	0	
Rear-dump Trucks		2.551.849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.551.849	0	0	0	
Percussion Drills		333.939	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	333.939	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydraulic Shovels		413.528	0	0	0	0	413.528	0	0	0	0	0	413.528	0	0	0	0	0	413.528	0	
(strippping)		0																			
Articulated Trucks		176.431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176.431	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	26.492	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45.082	0	0	0	
Sub total		**4.784.398**	**0**	**0**	**0**	**0**	**630.588**	**0**	**766.557**	**26.492**	**0**	**74.246**	**630.588**	**0**	**0**	**0**	**3.779.242**	**0**	**657.080**	**0**	**0**
Buildings																					
Workshop		104.256																			
Changehouse		377.250																			
Office		80.500																			
Stores		70.228																			
Powder Magazine		9.900																			
Primary Crusher House		1.000.000																			
Sub total		**1.642.134**																			
Engineering & Management																					
	300.000																				
Sub total	**300.000**																				
Total Capital	**300.000**	**6.426.532**	**0**	**0**	**0**	**0**	**630.588**	**0**	**766.557**	**26.492**	**0**	**74.246**	**630.588**	**0**	**0**	**0**	**3.779.242**	**0**	**657.080**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	5.103.699
Percussion Drills	1.001.817
Bulldozers	868.241
Graders	0
Hydraulic Shovels	1.654.110
(strippping)	
Articulated Trucks	352.862
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	273.830
Primary Crusher Motor	79.477
Light Plants	0
Pumps	148.491
Pickup Trucks	90.163
Sub Total:	11.349.190
	104.256
	377.250
	80.500
	70.228
	9.900
	1.000.000
Sub Total:	1.642.134
	300.000
Sub Total:	300.000
Grand Total	13.291.324

Quarry 2.500 tpd, 3 m Strip	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Front-end Loaders		432.618	0	0	0	0	0	0	432.618	0	0	0	0	0	0	0	432.618	0	0	0	
Rear-dump Trucks		2.551.849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.551.849	0	0	0	
Percussion Drills		333.939	0	0	0	0	0	0	333.939	0	0	0	0	0	0	0	333.939	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels		413.528	0	0	0	0	413.528	0	0	0	0	0	413.528	0	0	0	0	0	413.528	0	
(strippping)		0																			
Articulated Trucks		352.862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	352.862	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	
Primary Crusher		273.830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		26.492	0	0	0	0	0	0	0	26.492	0	0	0	0	0	0	0	0	26.492	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	
Pickup Trucks		45.082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45.082	0	0	0	
Sub total		**5.111.101**	**0**	**0**	**0**	**0**	**780.860**	**0**	**766.557**	**26.492**	**0**	**74.246**	**780.860**	**0**	**0**	**0**	**3.955.673**	**0**	**807.353**	**0**	**0**
Buildings																					
Workshop		104.256																			
Changehouse		377.250																			
Office		80.500																			
Stores		70.228																			
Powder Magazine		9.900																			
Primary Crusher House		1.000.000																			
Sub total		**1.642.134**																			
Engineering & Management																					
	350.000																				
Sub total	**350.000**																				
Total Capital	**350.000**	**6.753.235**	**0**	**0**	**0**	**0**	**780.860**	**0**	**766.557**	**26.492**	**0**	**74.246**	**780.860**	**0**	**0**	**0**	**3.955.673**	**0**	**807.353**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	0
Front-end Loaders	1.297.853
Rear-dump Trucks	5.103.699
Percussion Drills	1.001.817
Bulldozers	868.241
Graders	601.090
Hydraulic Shovels	1.654.110
(strippping)	
Articulated Trucks	705.724
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	273.830
Primary Crusher Motor	79.477
Light Plants	0
Pumps	148.491
Pickup Trucks	90.163
Sub Total:	12.303.142
	104.256
	377.250
	80.500
	70.228
	9.900
	1.000.000
Sub Total:	1.642.134
	350.000
Sub Total:	350.000
Grand Total	14.295.276

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates
Appendix H3

Disclaimer
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May 2010

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Characteristics	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Daily production rate	tonnes	1.500	1.500	1.500	2.500	2.500	2.500	5.000	5.000	5.000	14.000	14.000	14.000
Hourly production rate	tonnes	188	188	188	278	278	278	500	500	500	1.400	1.400	1.400
Annual production	kT	375	375	375	625	625	625	1.250	1.250	1.250	3.500	3.500	3.500
Shifts per day:		1	1	1	1	1	1	1	1	1	1	1	1
Workinghours / shift:	hours	8	8	8	9	9	9	10	10	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20	20	20	20	20
Mineable reserve	MT	7,5	7,5	7,5	12,5	12,5	12,5	25,0	25,0	25,0	70,0	70,0	70,0
Drill and Blast Specifications													
Bench height (stone)	metre	15	15	15	15	15	15	15	15	15	15	15	15
Blast size:	tonnes	10.000	10.000	10.000	12.000	12.000	12.000	12.000	12.000	12.000	15.000	15.000	15.000
Powder factor:	kg/tonne	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Drill factor:	m/tonne	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Blasthole diameter	metres	0,115	0,115	0,115	0,115	0,115	0,115	0,125	0,125	0,125	0,125	0,125	0,125
Blasthole spacing	metres	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Blasthole burden	metres	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Insitu rock density	kg/m^3	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650
Rows per blast	No.	2	2	2	2	2	2	2	2	2	3	3	3
Production faces	No.	1	1	1	1	1	1	2	2	2	2	2	2
Powder density	kg/m^3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Drill bit life	metres	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Pre-Production Development													
Ultimate Pit Area	hectare	25	25	25	50	50	50	100	100	100	100	100	100
Pre Strip Area	hectare	12,5	12,5	12,5	25,0	25,0	25,0	50,0	50,0	50,0	50,0	50,0	50,0
Pre Strip Depth	metres	0	1,5	3	0	1,5	3	0	1,5	3	0	1,5	3
Pre-Strip Volume	m^3	0	187.500	375.000	0	375.000	750.000	0	750.000	1.500.000	0	750.000	1.500.000
Preproduction Mass	tonnes	0	375.000	750.000	0	750.000	1.500.000	0	1.500.000	3.000.000	0	1.500.000	3.000.000
Initial Haul Roads	meter	282	282	282	399	399	399	564	564	564	564	564	564

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Initial Equipment	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	n°							1	1	1	2	2	2
	type							E0168	E0168	E0168	E0170	E0170	E0170
Front-end Loaders	n°	1	1	1	1	1	1	2	2	2	1	1	1
	type	E0133	E0133	E0133	E0133	E0133	E0133	E0134	E0134	E0134	E0134	E0134	E0134
Rear-dump Trucks	n°	2	2	2	4	5	5	6	6	6	7	7	7
	type	E0259	E0259	E0259	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261
Percussion Drills	n°	1	1	1	1	1	1	2	2	2	2	2	2
	mm	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077
Bulldozers	n°		1	1		1	1		1	1		1	1
	type		E0188	E0188		E0188	E0188		E0188	E0188		E0188	E0188
Graders	n°			1			1	1	1	1	1	1	1
	type			E0094			E0094	E0094	E0094	E0094	E0094	E0094	E0094
Hydraulic Shovels	n°		1	1		1	1		1	1		1	1
(strippping)	type		E0007	E0007		E0007	E0007		E0009	E0009		E0009	E0009
Articulated Trucks	n°		1	1		1	2		1	2		1	2
(strippping)	type		E0247	E0247		E0247	E0247		E0247	E0247		E0251	E0251
Water Tankers	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239
Service/Tyre Trucks	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234
Powder Truck	n°				1	1	1	1	1	1	1	1	1
	type				E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238
Primary Crusher	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	P0224	P0224	P0224	P0224	P0224	P0224	P0226	P0226	P0226	P0226	P0226	P0226
Primary Crusher Motor	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	BU0229	BU0229	BU0229	BU0229	BU0229	BU0229	BU0230	BU0230	BU0230	BU0230	BU0230	BU0230
Light Plants	n°												
	type												
Pumps	n°				2	2	2	2	2	2	2	2	2
	type				P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006
Pickup Trucks	n°	2	2	2	3	3	3	4	4	4	7	7	7
	type	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224

Quarry		**Daily Production**											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Buildings	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	199	199	199	288	288	288	486	486	486	486	486	486
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	168	168	168	250	250	250	221	221	221	221	221	221
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	100	100	100	125	125	125	160	160	160	160	160	160
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	149	149	149	194	194	194	297	297	297	297	297	297
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2				11	11	11	20	20	20	20	20	20
	type				B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Primary Crusher House	no	1	1	1	1	1	1	1	1	1	1	1	1
	type	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042
Consumables													
Diesel Fuel	liter/day	1540	2086	2215	2886	3879	4144	6421	7166	7299	7524	8287	8439
Electricity	kWh/day	2228	2228	2228	2707	2707	2707	3008	3008	3008	5793	5793	5793
Explosives	kg/day	224	224	224	376	376	376	752	752	752	2100	2100	2100
Caps	#/day	5	5	5	7	7	7	13	13	13	30	30	30
Primers	#/day	9	9	9	13	13	13	27	27	27	60	60	60
Drill Bits	#/day	0,04	0,04	0,04	0,07	0,07	0,07	0,13	0,13	0,13	0,37	0,37	0,37
Det. Cord	m/day	45	45	45	63	63	63	125	125	125	280	280	280
Personal - Hourly Rate													
Drillers	no				1	1	1	2	2	2	2	2	2
Blasters	no				1	1	1	1	1	1	1	1	1
Excavator Operators	no		1	1		1	1	1	2	2	2	3	3
Truck Drivers	no	2	3	3	4	6	7	6	7	8	7	8	9
Equipment Operators	no	2	2	2	1	1	1	2	2	2	1	1	1
Utility Operators	no				1	1	1	1	1	1	1	1	1
Mechanics	no	2	2	2	3	4	4	6	7	7	8	9	9
Labourers/Maintenance	no	1	1	1	1	1	1	2	2	2	4	4	4
Drillers	type	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001
Blasters	type	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002
Excavator Operators	type	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003
Truck Drivers	type	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004
Equipment Operators	type	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005
Utility Operators	type	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006
Mechanics	type	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007
Labourers/Maintenance	type	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008
Personel - Salaried													
Manager	no	1	1	1	1	1	1	1	1	1	1	1	1
Superintendent	no												
Foreman	no									1	2	2	2
Engineer	no												
Geologist	no												
Supervisor	no												
Technician	no												
Accountant	no												
Clerk	no	1	1	1	2	2	2	3	3	3	7	7	7
Personnel	no												
Secretary	no												
Security	no												
Manager	no	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	no	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	no	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	no	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	no	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	no	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	no	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	no	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	no	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	no	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	no	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	no	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		9	11	11	15	19	20	25	28	30	36	39	40

CAPEX		Items			Item Price			Total Cost			Equipment Life		
Quarry 5,000 tpd					GB£	GB£	GB£	GB£	GB£	GB£	(Years)		
Equipment		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	no	1	1	1	918332	918332	918332	918.332	918.332	918.332	5	5	5
	type	E0168	E0168	E0168									
Front-end Loaders	no	2	2	2	773.625	773.625	773.625	1.547.250	1.547.250	1.547.250	7	7	7
	type	E0134	E0134	E0134									
Rear-dump Trucks	no	6	6	6	510.370	510.370	510.370	3.062.219	3.062.219	3.062.219	15	15	15
	type	E0261	E0261	E0261									
Percussion Drills	no	2	2	2	333.939	333.939	333.939	667.878	667.878	667.878	7	7	7
	type	E0077	E0077	E0077									
Bulldozers	no	0	1	1	0	217.060	217.060	0	217.060	217.060	0	6	6
	type	0	E0188	E0188									
Graders	no	1	1	1	150.272	150.272	150.272	150.272	150.272	150.272	6	6	6
	type	E0094	E0094	E0094									
Hydraulic Shovels	no	0	1	1	0	537.642	537.642	0	537.642	537.642	0	5	5
(strippping)	type	0	E0009	E0009									
Articulated Trucks	no	0	1	2	0	176.431	176.431	0	176.431	352.862	0	15	15
(strippping)	type	0	E0247	E0247									
Water Tankers	no	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	15	15	15
	type	E0239	E0239	E0239									
Service/Tire Trucks	no	1	1	1	65.675	65.675	65.675	65.675	65.675	65.675	14	14	14
	type	E0234	E0234	E0234									
Powder Buggies	no	1	1	1	40.073	40.073	40.073	40.073	40.073	40.073	15	15	15
	type	E0238	E0238	E0238									
Primary Crusher	no	1	1	1	333.939	333.939	333.939	333.939	333.939	333.939	20	20	20
	type	P0226	P0226	P0226									
Primary Crusher Motor	no	1	1	1	21.316	21.316	21.316	21.316	21.316	21.316	8	8	8
	type	BU0230	BU0230	BU0230									
Light Plants	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Pumps	no	2	2	2	37.123	37.123	37.123	74.246	74.246	74.246	10	10	10
	type	P0006	P0006	P0006									
Pickup Trucks	no	4	4	4	15.027	15.027	15.027	60.109	60.109	60.109	15	15	15
	type	E0224	E0224	E0224									
								7.074.884	**8.006.017**	**8.182.448**			

CAPEX Quarry 5,000 tpd		Items			Item Price			Total Cost			Equipment Life (Years)		
					GB£	GB£	GB£	GB£	GB£	GB£			
Buildings		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m^2	486	486	486	362	362	362	175.932	175.932	175.932	20	20	20
	type	B0081	B0081	B0081									
Changehouse	m^2	221	221	221	1.509	1.509	1.509	333.489	333.489	333.489	20	20	20
	type	B0087	B0087	B0087									
Office	m^2	160	160	160	644	644	644	103.040	103.040	103.040	20	20	20
	type	B0086	B0086	B0086									
Stores	m^2	297	297	297	362	362	362	107.514	107.514	107.514	20	20	20
	type	B0081	B0081	B0081									
Powder Magazine	m^2	20	20	20	900	900	900	18.000	18.000	18.000	20	20	20
	type	B0041	B0041	B0041									
Primary Crusher House	no	1	1	1	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	20	20	20
	type	B0042	B0042	B0042									
					Sub Total:			**1.737.975**	**1.737.975**	**1.737.975**			
Working Capital													
25% of OPEX								797.083	761.910	797.083			
					Sub Total:			**797.083**	**761.910**	**797.083**			
Engineering & Management													
								200.000	300.000	350.000			
					Sub Total:			**200.000**	**300.000**	**350.000**			
Contingency													
					Sub Total:			**0**	**0**	**0**			
Haul Roads/Site Work													
site clearing													
					Sub Total:			**0**	**0**	**0**			

Total Capital: Incl. Equipment	**9.809.942**	**10.805.902**	**11.067.506**	**GB£**

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 5,000 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Equipment		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Hydraulic Shovels	no	1	1	1	27,93	27,93	27,93	0	0	0	2.070	2.070	2.070	57.951	57.951	57.951
	type	E0168	E0168	E0168							965	965	965			
Front-end Loaders	no	2	2	2	28,59	28,59	28,59	52.939	52.939	52.939	2.269	2.269	2.269	118.652	118.652	118.652
	type	E0134	E0134	E0134							1.190	1.190	1.190			
Rear-dump Trucks	no	6	6	6	12,26	12,26	12,26	48.020	48.020	48.020	4.141	4.141	4.141	152.582	152.582	152.582
	type	E0261	E0261	E0261							2.521	2.521	2.521			
Percussion Drills	no	2	2	2	17,30	17,30	17,30	0	0	0	1.757	1.757	1.757	71.787	71.787	71.787
	type	E0077	E0077	E0077							1.023	1.023	1.023			
Bulldozers	no	0	1	1	0,00	10,07	10,07	0	0	0	0	522	522	0	20.903	20.903
	type	0	E0188	E0188							0	216	216			
Graders	no	1	1	1	4,80	4,80	4,80	647	647	647	191	191	191	9.967	9.967	9.967
	type	E0094	E0094	E0094							161	161	161			
Hydraulic Shovels	no	0	1	1	0,00	16,55	16,55	0	0	0	0	681	681	0	34.334	34.334
(strippping)	type	0	E0009	E0009							0	395	395			
Articulated Trucks	no	0	1	2	0,00	4,84	4,84	0	3.626	7.253	0	144	288	0	10.047	20.095
(strippping)	type	0	E0247	E0247							0	133	266			
Water Tankers	no	1	1	1	5,11	5,11	5,11	1.035	1.035	1.035	250	250	250	10.602	10.602	10.602
	type	E0239	E0239	E0239							188	188	188			
Service/Tire Trucks	no	1	1	1	1,96	1,96	1,96	346	346	346	84	84	84	4.077	4.077	4.077
	type	E0234	E0234	E0234							80	80	80			
Powder Buggies	no	1	1	1	1,80	1,80	1,80	512	512	512	105	105	105	3.742	3.742	3.742
	type	E0238	E0238	E0238							200	200	200			
Primary Crusher	no	1	1	1	20,68	20,68	20,68	0	0	0	1.837	1.837	1.837	42.903	42.903	42.903
	type	P0226	P0226	P0226							0	0	0			
Primary Crusher Motor	no	1	1	1	0,60	0,60	0,60	0	0	0	116	116	116	1.236	1.236	1.236
	type	BU0230	BU0230	BU0230							4.642	4.642	4.642			
Light Plants	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Pumps	no	2	2	2	0,87	0,87	0,87	0	0	0	326	326	326	3.626	3.626	3.626
	type	P0006	P0006	P0006							371	371	371			
Pickup Trucks	no	4	4	4	0,57	0,57	0,57	231	231	231	4.035	4.035	4.035	4.758	4.758	4.758
	type	E0224	E0224	E0224							94	94	94			
								103.730	107.357	110.983						
													Sub Total:	481.882	547.167	557.214

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 5,000 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Buildings		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Workshop	m2	486	486	486	3,62	3,62	3,62							1.759	1.759	1.759
	type	B0081	B0081	B0081												
Changehouse	m2	221	221	221	15,09	15,09	15,09							3.335	3.335	3.335
	type	B0087	B0087	B0087												
Office	m2	160	160	160	6,44	6,44	6,44							1.030	1.030	1.030
	type	B0086	B0086	B0086												
Stores	m2	297	297	297	3,62	3,62	3,62							1.075	1.075	1.075
	type	B0081	B0081	B0081												
Powder Magazine	m2	20	20	20	9,00	9,00	9,00							180	180	180
	type	B0041	B0041	B0041												
Primary Crusher House	no	1	1	1	5.000,00	5.000,00	5.000,00							5.000	5.000	5.000
	type	B0042	B0042	B0042												
													Sub Total:	**12.380**	**12.380**	**12.380**
Consumables																
Diesel Fuel	liter/day	6.421	7.166	7.299	0,76	0,76	0,76				6.421	7.166	7.299	1.220.006	1.361.549	1.386.859
	type	C0001	C0001	C0001												
Electricity	kWh/day	3.008	3.008	3.008	0,08	0,08	0,08				5.013	5.013	5.013	58.656	58.656	58.656
	type	C0002	C0002	C0002							**3.008**	**3.008**	**3.008**			
Explosives	kg/day	752	752	752	0,50	0,50	0,50							94.000	94.000	94.000
	type	C0003	C0003	C0003												
Caps	#/day	13	13	13	1,50	1,50	1,50							5.000	5.000	5.000
	type	C0004	C0004	C0004												
Primers	#/day	27	27	27	2,30	2,30	2,30							15.333	15.333	15.333
	type	C0005	C0005	C0005												
Drill Bits	#/day	0	0	0	1.228,34	1.228,34	1.228,34							40.945	40.945	40.945
	type	C0056	C0056	C0056												
Det. Cord	m/day	125	125	125	0,25	0,25	0,25							7.813	7.813	7.813
	type	C0006	C0006	C0006												
Tyres	GB£/year	1	1	1	103.730	107.357	110.983							103.730	107.357	110.983
													Sub Total:	**1.545.483**	**1.690.652**	**1.719.589**
Personal Hourly Rate																
Drillers	no	2	2	2	11,88	11,88	11,88							59.375	59.375	59.375
Blasters	no	1	1	1	11,88	11,88	11,88							29.688	29.688	29.688
Excavator Operators	no	1	2	2	10,00	10,00	10,00							25.000	50.000	50.000
Truck Drivers	no	6	7	8	10,00	10,00	10,00							150.000	175.000	200.000
Equipment Operators	no	2	2	2	9,38	9,38	9,38							46.875	46.875	46.875
Utility Operators	no	1	1	1	11,88	11,88	11,88							29.688	29.688	29.688
Mechanics	no	6	7	7	11,88	11,88	11,88				15.227	16.574	16.718	180.815	196.816	198.525
Laborers/Maintenance	no	2	2	2	8,75	8,75	8,75							43.750	43.750	43.750
Personel Fixed Wages																
Manager	no	1	1	1	84.000	84.000	84.000							84.000	84.000	84.000
Superintendent	no	0	0	0	70.000	70.000	70.000							0	0	0
Foreman	no	0	0	1	75.000	75.000	75.000							0	0	75.000
Engineer	no	0	0	0	52.000	52.000	52.000							0	0	0
Geologist	no	0	0	0	52.000	52.000	52.000							0	0	0
Supervisor	no	0	0	0	39.000	39.000	39.000							0	0	0
Technician	no	0	0	0	52.000	52.000	52.000							0	0	0
Accountant	no	0	0	0	70.000	70.000	70.000							0	0	0
Clerk	no	3	3	3	27.500	27.500	27.500							82.500	82.500	82.500
Personnel	no	0	0	0	37.500	37.500	37.500							0	0	0
Secretary	no	0	0	0	27.500	27.500	27.500							0	0	0
Security	no	0	0	0	25.000	25.000	25.000							0	0	0
													Sub Total:	**731.690**	**797.691**	**899.400**

Total Operational:	**2.771.435**	**3.047.890**	**3.188.583**	**GB£**
Incl. Equipment				

Quarry 5.000 tpd, No Strip	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		918.332	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	
Front-end Loaders		1.547.250	0	0	0	0	0	1.547.250	0	0	0	0	0	0	1.547.250	0	0	0	0	0	
Rear-dump Trucks		3.062.219	0	0	0	0	0	0	0	0	0	0	0	0	0	3.062.219	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Articulated Trucks (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	0	0	0	0	0	0	60.109	0	0	0	0	
Sub total		**7.074.884**	**0**	**0**	**0**	**918.332**	**150.272**	**2.215.128**	**21.316**	**0**	**992.578**	**0**	**150.272**	**0**	**2.280.802**	**4.214.308**	**21.316**	**0**	**150.272**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	200.000																				
Sub total	**200.000**																				
Total Capital	**200.000**	**8.812.859**	**0**	**0**	**0**	**918.332**	**150.272**	**2.215.128**	**21.316**	**0**	**992.578**	**0**	**150.272**	**0**	**2.280.802**	**4.214.308**	**21.316**	**0**	**150.272**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	3.673.327
Front-end Loaders	4.641.750
Rear-dump Trucks	6.124.439
Percussion Drills	2.003.633
Bulldozers	0
Graders	601.090
Hydraulic Shovels (strippping)	0
Articulated Trucks (strippping)	0
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	120.218
Sub Total:	18.189.482
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	200.000
Sub Total:	200.000
Grand Total	20.127.457

Quarry 5.000 tpd, 1,5 m Strip		CAPEX																			
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		918.332	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	
Front-end Loaders		1.547.250	0	0	0	0	0	1.547.250	0	0	0	0	0	0	1.547.250	0	0	0	0	0	
Rear-dump Trucks		3.062.219	0	0	0	0	0	0	0	0	0	0	0	0	0	3.062.219	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels		537.642	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	
(strippping)		0																			
Articulated Trucks		176.431	0	0	0	0	0	0	0	0	0	0	0	0	0	176.431	0	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	0	0	0	0	0	0	60.109	0	0	0	0	
Sub total		**8.006.017**	**0**	**0**	**0**	**1.455.973**	**367.333**	**2.215.128**	**21.316**	**0**	**1.530.219**	**0**	**367.333**	**0**	**2.280.802**	**4.928.381**	**21.316**	**0**	**367.333**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	300.000																				
Sub total	**300.000**																				
Total Capital	**300.000**	**9.743.992**	**0**	**0**	**0**	**1.455.973**	**367.333**	**2.215.128**	**21.316**	**0**	**1.530.219**	**0**	**367.333**	**0**	**2.280.802**	**4.928.381**	**21.316**	**0**	**367.333**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	3.673.327
Front-end Loaders	4.641.750
Rear-dump Trucks	6.124.439
Percussion Drills	2.003.633
Bulldozers	868.241
Graders	601.090
Hydraulic Shovels	2.150.566
(strippping)	
Articulated Trucks	352.862
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	120.218
Sub Total:	21.561.151
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	300.000
Sub Total:	300.000
Grand Total	23.599.126

Quarry 5.000 tpd, 3 m Strip		**CAPEX**																			
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		918.332	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	918.332	0	0	0	0	
Front-end Loaders		1.547.250	0	0	0	0	0	1.547.250	0	0	0	0	0	0	1.547.250	0	0	0	0	0	
Rear-dump Trucks		3.062.219	0	0	0	0	0	0	0	0	0	0	0	0	0	3.062.219	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels		537.642	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	
(strippping)		0																			
Articulated Trucks		352.862	0	0	0	0	0	0	0	0	0	0	0	0	0	352.862	0	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		60.109	0	0	0	0	0	0	0	0	0	0	0	0	0	60.109	0	0	0	0	
Sub total		**8.182.448**	**0**	**0**	**0**	**1.455.973**	**367.333**	**2.215.128**	**21.316**	**0**	**1.530.219**	**0**	**367.333**	**0**	**2.280.802**	**5.104.812**	**21.316**	**0**	**367.333**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	350.000																				
Sub total	**350.000**																				
Total Capital	**350.000**	**9.920.423**	**0**	**0**	**0**	**1.455.973**	**367.333**	**2.215.128**	**21.316**	**0**	**1.530.219**	**0**	**367.333**	**0**	**2.280.802**	**5.104.812**	**21.316**	**0**	**367.333**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	3.673.327
Front-end Loaders	4.641.750
Rear-dump Trucks	6.124.439
Percussion Drills	2.003.633
Bulldozers	868.241
Graders	601.090
Hydraulic Shovels	2.150.566
(strippping)	
Articulated Trucks	705.724
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	120.218
Sub Total:	21.914.013
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	350.000
Sub Total:	350.000
Grand Total	24.001.988

ASRP Project No. 7 Assess the feasibility of the underground mining of aggregates
Contract Number: MA/1/S/7/01

Underground Mining of Aggregates Appendix H4

Disclaimer
This publication and references within it to any methodology, process, service, manufacturer, or company do not constitute its endorsement or recommendation by the Mineral Industry Research Organisation or The Department for Environment, Food and Rural Affairs.

May 2010

Quarry		**Daily Production**											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Characteristics	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Daily production rate	tonnes	1.500	1.500	1.500	2.500	2.500	2.500	5.000	5.000	5.000	14.000	14.000	14.000
Hourly production rate	tonnes	188	188	188	278	278	278	500	500	500	1.400	1.400	1.400
Annual production	kT	375	375	375	625	625	625	1.250	1.250	1.250	3.500	3.500	3.500
Shifts per day:		1	1	1	1	1	1	1	1	1	1	1	1
Workinghours / shift:	hours	8	8	8	9	9	9	10	10	10	10	10	10
Workingdays / year:	days	250	250	250	250	250	250	250	250	250	250	250	250
Life Of Mine (LOM):	years	20	20	20	20	20	20	20	20	20	20	20	20
Mineable reserve	MT	7,5	7,5	7,5	12,5	12,5	12,5	25,0	25,0	25,0	70,0	70,0	70,0
Drill and Blast Specifications													
Bench height (stone)	metre	15	15	15	15	15	15	15	15	15	15	15	15
Blast size:	tonnes	10.000	10.000	10.000	12.000	12.000	12.000	12.000	12.000	12.000	15.000	15.000	15.000
Powder factor:	kg/tonne	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
Drill factor:	m/tonne	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
Blasthole diameter	metres	0,115	0,115	0,115	0,115	0,115	0,115	0,125	0,125	0,125	0,125	0,125	0,125
Blasthole spacing	metres	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Blasthole burden	metres	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Insitu rock density	kg/m^3	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650	2.650
Rows per blast	No.	2	2	2	2	2	2	2	2	2	3	3	3
Production faces	No.	1	1	1	1	1	1	2	2	2	2	2	2
Powder density	kg/m^3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Drill bit life	metres	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Pre-Production Development													
Ultimate Pit Area	hectare	25	25	25	50	50	50	100	100	100	100	100	100
Pre Strip Area	hectare	12,5	12,5	12,5	25,0	25,0	25,0	50,0	50,0	50,0	50,0	50,0	50,0
Pre Strip Depth	metres	0	1,5	3	0	1,5	3	0	1,5	3	0	1,5	3
Pre-Strip Volume	m^3	0	187.500	375.000	0	375.000	750.000	0	750.000	1.500.000	0	750.000	1.500.000
Preproduction Mass	tonnes	0	375.000	750.000	0	750.000	1.500.000	0	1.500.000	3.000.000	0	1.500.000	3.000.000
Initial Haul Roads	meter	282	282	282	399	399	399	564	564	564	564	564	564

Quarry		Daily Production											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Initial Equipment	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	n°							1	1	1	2	2	2
	type							E0168	E0168	E0168	E0170	E0170	E0170
Front-end Loaders	n°	1	1	1	1	1	1	2	2	2	1	1	1
	type	E0133	E0133	E0133	E0133	E0133	E0133	E0134	E0134	E0134	E0134	E0134	E0134
Rear-dump Trucks	n°	2	2	2	4	5	5	6	6	6	7	7	7
	type	E0259	E0259	E0259	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261	E0261
Percussion Drills	n°	1	1	1	1	1	1	2	2	2	2	2	2
	mm	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077	E0077
Bulldozers	n°		1	1		1	1		1	1		1	1
	type		E0188	E0188		E0188	E0188		E0188	E0188		E0188	E0188
Graders	n°			1			1	1	1	1	1	1	1
	type			E0094			E0094	E0094	E0094	E0094	E0094	E0094	E0094
Hydraulic Shovels	n°		1	1		1	1		1	1		1	1
(strippping)	type		E0007	E0007		E0007	E0007		E0009	E0009		E0009	E0009
Articulated Trucks	n°		1	1		1	2		1	2		1	2
(strippping)	type		E0247	E0247		E0247	E0247		E0247	E0247		E0251	E0251
Water Tankers	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239	E0239
Service/Tyre Trucks	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234	E0234
Powder Truck	n°				1	1	1	1	1	1	1	1	1
	type				E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238	E0238
Primary Crusher	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	P0224	P0224	P0224	P0224	P0224	P0224	P0226	P0226	P0226	P0226	P0226	P0226
Primary Crusher Motor	n°	1	1	1	1	1	1	1	1	1	1	1	1
	type	BU0229	BU0229	BU0229	BU0229	BU0229	BU0229	BU0230	BU0230	BU0230	BU0230	BU0230	BU0230
Light Plants	n°												
	type												
Pumps	n°				2	2	2	2	2	2	2	2	2
	type				P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006	P0006
Pickup Trucks	n°	2	2	2	3	3	3	4	4	4	7	7	7
	type	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224	E0224

Quarry		**Daily Production**											
Daily Production:		**1.500**	**1.500**	**1.500**	**2.500**	**2.500**	**2.500**	**5.000**	**5.000**	**5.000**	**14.000**	**14.000**	**14.000**
Buildings	**Strip**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	199	199	199	288	288	288	486	486	486	486	486	486
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Changehouse	m2	168	168	168	250	250	250	221	221	221	221	221	221
	type	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087	B0087
Office	m2	100	100	100	125	125	125	160	160	160	160	160	160
	type	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086	B0086
Stores	m2	149	149	149	194	194	194	297	297	297	297	297	297
	type	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081	B0081
Powder Magazine	m2				11	11	11	20	20	20	20	20	20
	type				B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041	B0041
Primary Crusher House	no	1	1	1	1	1	1	1	1	1	1	1	1
	type	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042	B0042
Consumables													
Diesel Fuel	liter/day	1540	2086	2215	2886	3879	4144	6421	7166	7299	7524	8287	8439
Electricity	kWh/day	2228	2228	2228	2707	2707	2707	3008	3008	3008	5793	5793	5793
Explosives	kg/day	224	224	224	376	376	376	752	752	752	2100	2100	2100
Caps	#/day	5	5	5	7	7	7	13	13	13	30	30	30
Primers	#/day	9	9	9	13	13	13	27	27	27	60	60	60
Drill Bits	#/day	0,04	0,04	0,04	0,07	0,07	0,07	0,13	0,13	0,13	0,37	0,37	0,37
Det. Cord	m/day	45	45	45	63	63	63	125	125	125	280	280	280
Personal - Hourly Rate													
Drillers	no				1	1	1	2	2	2	2	2	2
Blasters	no				1	1	1	1	1	1	1	1	1
Excavator Operators	no		1	1		1	1	1	2	2	2	3	3
Truck Drivers	no	2	3	3	4	6	7	6	7	8	7	8	9
Equipment Operators	no	2	2	2	1	1	1	2	2	2	1	1	1
Utility Operators	no				1	1	1	1	1	1	1	1	1
Mechanics	no	2	2	2	3	4	4	6	7	7	8	9	9
Labourers/Maintenance	no	1	1	1	1	1	1	2	2	2	4	4	4
Drillers	type	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001	L0001
Blasters	type	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002	L0002
Excavator Operators	type	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003	L0003
Truck Drivers	type	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004	L0004
Equipment Operators	type	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005	L0005
Utility Operators	type	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006	L0006
Mechanics	type	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007	L0007
Labourers/Maintenance	type	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008	L0008
Personel - Salaried													
Manager	no	1	1	1	1	1	1	1	1	1	1	1	1
Superintendent	no												
Foreman	no									1	2	2	2
Engineer	no												
Geologist	no												
Supervisor	no												
Technician	no												
Accountant	no												
Clerk	no	1	1	1	2	2	2	3	3	3	7	7	7
Personnel	no												
Secretary	no												
Security	no												
Manager	no	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021	L0021
Superintendent	no	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022	L0022
Foreman	no	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023	L0023
Engineer	no	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024	L0024
Geologist	no	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025	L0025
Supervisor	no	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026	L0026
Technician	no	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027	L0027
Accountant	no	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028	L0028
Clerk	no	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029	L0029
Personnel	no	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030	L0030
Secretary	no	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031	L0031
Security	no	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032	L0032
No. of people on payroll		9	11	11	15	19	20	25	28	30	36	39	40

CAPEX		Items			Item Price			Total Cost			Equipment Life		
Quarry 14,000 tpd					GB£	GB£	GB£	GB£	GB£	GB£	(Years)		
Equipment		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Hydraulic Shovels	no	2	2	2	923897	923897	923897	1.847.795	1.847.795	1.847.795	5	5	5
	type	E0170	E0170	E0170									
Front-end Loaders	no	1	1	1	773.625	773.625	773.625	773.625	773.625	773.625	7	7	7
	type	E0134	E0134	E0134									
Rear-dump Trucks	no	7	7	7	510.370	510.370	510.370	3.572.589	3.572.589	3.572.589	15	15	15
	type	E0261	E0261	E0261									
Percussion Drills	no	2	2	2	333.939	333.939	333.939	667.878	667.878	667.878	7	7	7
	type	E0077	E0077	E0077									
Bulldozers	no	0	1	1	0	217.060	217.060	0	217.060	217.060	0	6	6
	type	0	E0188	E0188									
Graders	no	1	1	1	150.272	150.272	150.272	150.272	150.272	150.272	6	6	6
	type	E0094	E0094	E0094									
Hydraulic Shovels	no	0	1	1	0	537.642	537.642	0	537.642	537.642	0	5	5
(strippping)	type	0	E0009	E0009									
Articulated Trucks	no	0	1	2	0	200.363	200.363	0	200.363	400.727	0	15	15
(strippping)	type	0	E0251	E0251									
Water Tankers	no	1	1	1	133.576	133.576	133.576	133.576	133.576	133.576	15	15	15
	type	E0239	E0239	E0239									
Service/Tire Trucks	no	1	1	1	65.675	65.675	65.675	65.675	65.675	65.675	14	14	14
	type	E0234	E0234	E0234									
Powder Buggies	no	1	1	1	40.073	40.073	40.073	40.073	40.073	40.073	15	15	15
	type	E0238	E0238	E0238									
Primary Crusher	no	1	1	1	333.939	333.939	333.939	333.939	333.939	333.939	20	20	20
	type	P0226	P0226	P0226									
Primary Crusher Motor	no	1	1	1	21.316	21.316	21.316	21.316	21.316	21.316	8	8	8
	type	BU0230	BU0230	BU0230									
Light Plants	no	0	0	0	0	0	0	0	0	0	0	0	0
	type	0	0	0									
Pumps	no	2	2	2	37.123	37.123	37.123	74.246	74.246	74.246	10	10	10
	type	P0006	P0006	P0006									
Pickup Trucks	no	7	7	7	15.027	15.027	15.027	105.191	105.191	105.191	15	15	15
	type	E0224	E0224	E0224									
								7.786.174	**8.741.239**	**8.941.602**			

CAPEX		Items			Item Price			Total Cost			Equipment Life		
Quarry 14,000 tpd					GB£	GB£	GB£	GB£	GB£	GB£	(Years)		
Buildings		**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**	**0**	**1,5**	**3**
Workshop	m2	486	486	486	362	362	362	175.932	175.932	175.932	20	20	20
	type	B0081	B0081	B0081									
Changehouse	m2	221	221	221	1.509	1.509	1.509	333.489	333.489	333.489	20	20	20
	type	B0087	B0087	B0087									
Office	m2	160	160	160	644	644	644	103.040	103.040	103.040	20	20	20
	type	B0086	B0086	B0086									
Stores	m2	297	297	297	362	362	362	107.514	107.514	107.514	20	20	20
	type	B0081	B0081	B0081									
Powder Magazine	m2	20	20	20	900	900	900	18.000	18.000	18.000	20	20	20
	type	B0041	B0041	B0041									
Primary Crusher House	no	1	1	1	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	20	20	20
	type	B0042	B0042	B0042									
					Sub Total:			**1.737.975**	**1.737.975**	**1.737.975**			
Working Capital													
25% of OPEX								877.660	967.384	985.590			
					Sub Total:			**877.660**	**967.384**	**985.590**			
Engineering & Management													
								200.000	300.000	350.000			
					Sub Total:			**200.000**	**300.000**	**350.000**			
Contingency													
					Sub Total:			**0**	**0**	**0**			
Haul Roads/Site Work													
site clearing													
					Sub Total:			**0**	**0**	**0**			

Total Capital:	**10.601.809**	**11.746.598**	**12.015.167**	**GB£**
Incl. Equipment				

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 14,000 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Equipment		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Hydraulic Shovels	no	2	2	2	28,21	28,21	28,21	0	0	0	4.167	4.167	4.167	117.058	117.058	117.058
	type	E0170	E0170	E0170							2.172	2.172	2.172			
Front-end Loaders	no	1	1	1	28,59	28,59	28,59	26.470	26.470	26.470	1.134	1.134	1.134	59.326	59.326	59.326
	type	E0134	E0134	E0134							595	595	595			
Rear-dump Trucks	no	7	7	7	12,26	12,26	12,26	56.023	56.023	56.023	4.831	4.831	4.831	178.012	178.012	178.012
	type	E0261	E0261	E0261							2.941	2.941	2.941			
Percussion Drills	no	2	2	2	17,30	17,30	17,30	0	0	0	1.757	1.757	1.757	71.787	71.787	71.787
	type	E0077	E0077	E0077							1.023	1.023	1.023			
Bulldozers	no	0	1	1	0,00	10,07	10,07	0	0	0	0	522	522	0	20.903	20.903
	type	0	E0188	E0188							0	216	216			
Graders	no	1	1	1	4,80	4,80	4,80	647	647	647	191	191	191	9.967	9.967	9.967
	type	E0094	E0094	E0094							161	161	161			
Hydraulic Shovels	no	0	1	1	0,00	16,55	16,55	0	0	0	0	681	681	0	34.334	34.334
(strippping)	type	0	E0009	E0009							0	395	395			
Articulated Trucks	no	0	1	2	0,00	5,86	5,86	0	4.874	9.747	0	163	327	0	12.161	24.322
(strippping)	type	0	E0251	E0251							0	152	304			
Water Tankers	no	1	1	1	5,11	5,11	5,11	1.035	1.035	1.035	250	250	250	10.602	10.602	10.602
	type	E0239	E0239	E0239							188	188	188			
Service/Tire Trucks	no	1	1	1	1,96	1,96	1,96	346	346	346	84	84	84	4.077	4.077	4.077
	type	E0234	E0234	E0234							80	80	80			
Powder Buggies	no	1	1	1	1,80	1,80	1,80	512	512	512	105	105	105	3.742	3.742	3.742
	type	E0238	E0238	E0238							200	200	200			
Primary Crusher	no	1	1	1	20,68	20,68	20,68	0	0	0	1.837	1.837	1.837	42.903	42.903	42.903
	type	P0226	P0226	P0226							0	0	0			
Primary Crusher Motor	no	1	1	1	0,60	0,60	0,60	0	0	0	116	116	116	1.236	1.236	1.236
	type	BU0230	BU0230	BU0230							9.284	9.284	9.284			
Light Plants	no	0	0	0	0,00	0,00	0,00	0	0	0	0	0	0	0	0	0
	type	0	0	0							0	0	0			
Pumps	no	2	2	2	0,87	0,87	0,87	0	0	0	326	326	326	3.626	3.626	3.626
	type	P0006	P0006	P0006							371	371	371			
Pickup Trucks	no	7	7	7	0,57	0,57	0,57	404	404	404	7.061	7.061	7.061	8.327	8.327	8.327
	type	E0224	E0224	E0224							165	165	165			
								85.437	90.311	95.184						
													Sub Total:	**510.661**	**578.060**	**590.220**

OPEX		Items			Item Price			Tyre Costs			Labour & Fuel			Total Cost		
Quarry 14,000 tpd					GB£	GB£	GB£	GB£/year	GB£/year	GB£/year	Hr / year	Hr / year	Hr / year	GB£	GB£	GB£
Buildings		0	1,5	3	0	1,5	3	0	1,5	3	liter / day	liter / day	liter / day	0	1,5	3
Workshop	m2	486	486	486	3,62	3,62	3,62							1.759	1.759	1.759
	type	B0081	B0081	B0081												
Changehouse	m2	221	221	221	15,09	15,09	15,09							3.335	3.335	3.335
	type	B0087	B0087	B0087												
Office	m2	160	160	160	6,44	6,44	6,44							1.030	1.030	1.030
	type	B0086	B0086	B0086												
Stores	m2	297	297	297	3,62	3,62	3,62							1.075	1.075	1.075
	type	B0081	B0081	B0081												
Powder Magazine	m2	20	20	20	9,00	9,00	9,00							180	180	180
	type	B0041	B0041	B0041												
Primary Crusher House	no	1	1	1	5.000,00	5.000,00	5.000,00							5.000	5.000	5.000
	type	B0042	B0042	B0042												
													Sub Total:	**12.380**	**12.380**	**12.380**
Consumables																
Diesel Fuel	liter/day	7.524	8.287	8.439	0,76	0,76	0,76				7.524	8.287	8.439	1.429.481	1.574.561	1.603.409
	type	C0001	C0001	C0001												
Electricity	kWh/day	5.793	9.655	9.655	0,08	0,08	0,08				9.655	9.655	9.655	112.967	188.279	188.279
	type	C0002	C0002	C0002							**5.793**	**5.793**	**5.793**			
Explosives	kg/day	2.100	2.100	2.100	0,50	0,50	0,50							262.500	262.500	262.500
	type	C0003	C0003	C0003							1392594,563					
Caps	#/day	30	30	30	1,50	1,50	1,50				1.448.298,35			11.200	11.200	11.200
	type	C0004	C0004	C0004												
Primers	#/day	60	60	60	2,30	2,30	2,30							34.347	34.347	34.347
	type	C0005	C0005	C0005												
Drill Bits	#/day	0	0	0	1.228,34	1.228,34	1.228,34							114.645	114.645	114.645
	type	C0056	C0056	C0056												
Det. Cord	m/day	280	280	280	0,25	0,25	0,25							17.500	17.500	17.500
	type	C0006	C0006	C0006												
Tyres	GB£/year	1	1	1	85.437	90.311	95.184							85.437	90.311	95.184
													Sub Total:	**2.068.077**	**2.293.342**	**2.327.063**
Personal Hourly Rate																
Drillers	no	2	2	2	11,88	11,88	11,88							59.375	59.375	59.375
Blasters	no	1	1	1	11,88	11,88	11,88							29.688	29.688	29.688
Excavator Operators	no	2	3	3	10,00	10,00	10,00							50.000	75.000	75.000
Truck Drivers	no	7	8	9	10,00	10,00	10,00							175.000	200.000	225.000
Equipment Operators	no	1	1	1	9,38	9,38	9,38							23.438	23.438	23.438
Utility Operators	no	1	1	1	11,88	11,88	11,88							29.688	29.688	29.688
Mechanics	no	8	9	9	11,88	11,88	11,88				19.904	21.271	21.435	236.365	252.599	254.539
Laborers/Maintenance	no	4	4	4	8,75	8,75	8,75							87.500	87.500	87.500
Personel Fixed Wages																
Manager	no	1	1	1	84.000	84.000	84.000							84.000	84.000	84.000
Superintendent	no	0	0	0	70.000	70.000	70.000							0	0	0
Foreman	no	2	2	2	75.000	75.000	75.000							150.000	150.000	150.000
Engineer	no	0	0	0	52.000	52.000	52.000							0	0	0
Geologist	no	0	0	0	52.000	52.000	52.000							0	0	0
Supervisor	no	0	0	0	39.000	39.000	39.000							0	0	0
Technician	no	0	0	0	52.000	52.000	52.000							0	0	0
Accountant	no	0	0	0	70.000	70.000	70.000							0	0	0
Clerk	no	7	7	7	27.500	27.500	27.500							192.500	192.500	192.500
Personnel	no	0	0	0	37.500	37.500	37.500							0	0	0
Secretary	no	0	0	0	27.500	27.500	27.500							0	0	0
Security	no	0	0	0	25.000	25.000	25.000							0	0	0
													Sub Total:	**1.117.553**	**1.183.786**	**1.210.727**

Total Operational:	**3.708.671**	**4.067.567**	**4.140.390**	**GB£**
Incl. Equipment				

Quarry 14.000 tpd, No Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		1.847.795	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	
Front-end Loaders		773.625	0	0	0	0	0	773.625	0	0	0	0	0	0	773.625	0	0	0	0	0	
Rear-dump Trucks		3.572.589	0	0	0	0	0	0	0	0	0	0	0	0	0	3.572.589	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Articulated Trucks (strippping)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		105.191	0	0	0	0	0	0	0	0	0	0	0	0	0	105.191	0	0	0	0	
Sub total		**7.786.174**	**0**	**0**	**0**	**1.847.795**	**150.272**	**1.441.503**	**21.316**	**0**	**1.922.041**	**0**	**150.272**	**0**	**1.507.177**	**5.699.223**	**21.316**	**0**	**150.272**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	200.000																				
Sub total	**200.000**																				
Total Capital	**200.000**	**9.524.149**	**0**	**0**	**0**	**1.847.795**	**150.272**	**1.441.503**	**21.316**	**0**	**1.922.041**	**0**	**150.272**	**0**	**1.507.177**	**5.699.223**	**21.316**	**0**	**150.272**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	7.391.180
Front-end Loaders	2.320.875
Rear-dump Trucks	7.145.178
Percussion Drills	2.003.633
Bulldozers	0
Graders	601.090
Hydraulic Shovels (strippping)	0
Articulated Trucks (strippping)	0
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	210.381
Sub Total:	20.697.363
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	200.000
Sub Total:	200.000
Grand Total	22.635.338

Quarry 14.000 tpd, 1,5 m Strip	CAPEX																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		1.847.795	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	
Front-end Loaders		773.625	0	0	0	0	0	773.625	0	0	0	0	0	0	773.625	0	0	0	0	0	
Rear-dump Trucks		3.572.589	0	0	0	0	0	0	0	0	0	0	0	0	0	3.572.589	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels		537.642	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	
(strippping)		0																			
Articulated Trucks		200.363	0	0	0	0	0	0	0	0	0	0	0	0	0	200.363	0	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		105.191	0	0	0	0	0	0	0	0	0	0	0	0	0	105.191	0	0	0	0	
Sub total		**8.741.239**	**0**	**0**	**0**	**2.385.437**	**367.333**	**1.441.503**	**21.316**	**0**	**2.459.682**	**0**	**367.333**	**0**	**1.507.177**	**6.437.228**	**21.316**	**0**	**367.333**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	300.000																				
Sub total	**300.000**																				
Total Capital	**300.000**	**10.479.214**	**0**	**0**	**0**	**2.385.437**	**367.333**	**1.441.503**	**21.316**	**0**	**2.459.682**	**0**	**367.333**	**0**	**1.507.177**	**6.437.228**	**21.316**	**0**	**367.333**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	7.391.180
Front-end Loaders	2.320.875
Rear-dump Trucks	7.145.178
Percussion Drills	2.003.633
Bulldozers	868.241
Graders	601.090
Hydraulic Shovels	2.150.566
(strippping)	
Articulated Trucks	400.727
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	210.381
Sub Total:	24.116.897
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	300.000
Sub Total:	300.000
Grand Total	26.154.872

Quarry 14.000 tpd, 3 m Strip	**CAPEX**																				
Project Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Hydraulic Shovels		1.847.795	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	1.847.795	0	0	0	0	
Front-end Loaders		773.625	0	0	0	0	0	773.625	0	0	0	0	0	0	773.625	0	0	0	0	0	
Rear-dump Trucks		3.572.589	0	0	0	0	0	0	0	0	0	0	0	0	0	3.572.589	0	0	0	0	
Percussion Drills		667.878	0	0	0	0	0	667.878	0	0	0	0	0	0	667.878	0	0	0	0	0	
Bulldozers		217.060	0	0	0	0	217.060	0	0	0	0	0	217.060	0	0	0	0	0	217.060	0	
Graders		150.272	0	0	0	0	150.272	0	0	0	0	0	150.272	0	0	0	0	0	150.272	0	
Hydraulic Shovels		537.642	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	537.642	0	0	0	0	
(strippping)		0																			
Articulated Trucks		400.727	0	0	0	0	0	0	0	0	0	0	0	0	0	400.727	0	0	0	0	
(strippping)		0																			
Water Tankers		133.576	0	0	0	0	0	0	0	0	0	0	0	0	0	133.576	0	0	0	0	
Service/Tire Trucks		65.675	0	0	0	0	0	0	0	0	0	0	0	0	65.675	0	0	0	0	0	
Powder Buggies		40.073	0	0	0	0	0	0	0	0	0	0	0	0	0	40.073	0	0	0	0	
Primary Crusher		333.939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Primary Crusher Motor		21.316	0	0	0	0	0	0	21.316	0	0	0	0	0	0	0	21.316	0	0	0	
Light Plants		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pumps		74.246	0	0	0	0	0	0	0	0	74.246	0	0	0	0	0	0	0	0	0	
Pickup Trucks		105.191	0	0	0	0	0	0	0	0	0	0	0	0	0	105.191	0	0	0	0	
Sub total		**8.941.602**	**0**	**0**	**0**	**2.385.437**	**367.333**	**1.441.503**	**21.316**	**0**	**2.459.682**	**0**	**367.333**	**0**	**1.507.177**	**6.637.591**	**21.316**	**0**	**367.333**	**0**	**0**
Buildings																					
Workshop		175.932																			
Changehouse		333.489																			
Office		103.040																			
Stores		107.514																			
Powder Magazine		18.000																			
Primary Crusher House		1.000.000																			
Sub total		**1.737.975**																			
Engineering & Management																					
	350.000																				
Sub total	**350.000**																				
Total Capital	**350.000**	**10.679.577**	**0**	**0**	**0**	**2.385.437**	**367.333**	**1.441.503**	**21.316**	**0**	**2.459.682**	**0**	**367.333**	**0**	**1.507.177**	**6.637.591**	**21.316**	**0**	**367.333**	**0**	**0**

CAPEX Totals	
Hydraulic Shovels	7.391.180
Front-end Loaders	2.320.875
Rear-dump Trucks	7.145.178
Percussion Drills	2.003.633
Bulldozers	868.241
Graders	601.090
Hydraulic Shovels	2.150.566
(strippping)	
Articulated Trucks	801.453
(strippping)	
Water Tankers	267.151
Service/Tire Trucks	131.349
Powder Buggies	80.145
Primary Crusher	333.939
Primary Crusher Motor	63.949
Light Plants	0
Pumps	148.491
Pickup Trucks	210.381
Sub Total:	24.517.623
	175.932
	333.489
	103.040
	107.514
	18.000
	1.000.000
Sub Total:	1.737.975
	350.000
Sub Total:	350.000
Grand Total	26.605.598