

Roadstone Provinces Ltd.

**EXTENSION TO EXISTING QUARRY (OPENCAST MINE)
(SECTION 261 QUARRY REF. QY2)**

AT

**DUNBELL BIG, MADDOCKSTOWN, BENNETTSBRIDGE,
CO. KILKENNY**

ENVIRONMENTAL IMPACT STATEMENT

September 2008

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CONTENTS

1. INTRODUCTION

GENERAL

THE APPLICANT

BACKGROUND TO THE APPLICATION

PLANNING STATUS

AIMS OF THE ENVIRONMENTAL IMPACT STATEMENT

FORMAT OF THE ENVIRONMENTAL IMPACT STATEMENT

THE EXISTING SITE

PROPOSED DEVELOPMENT

CONSULTATIONS

PROJECT TEAM

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

THE NEED FOR THE PROPOSED DEVELOPMENT

CONSIDERATION OF ALTERNATIVES

PRELIMINARY WORKS PHASE

OPERATIONAL PHASE

RESTORATION & AFTERCARE

3. EXISTING ENVIRONMENT, POTENTIAL IMPACTS & MITIGATION MEASURES

HUMAN BEINGS

FLORA & FAUNA

SOILS & GEOLOGY

SURFACE & GROUNDWATER

CLIMATE

AIR QUALITY

NOISE & VIBRATION

LANDSCAPE

CULTURAL HERITAGE

MATERIAL ASSETS

TRAFFIC

THE INTERACTION OF THE FOREGOING

SECTION 1 – INTRODUCTION

CONTENTS

- 1.1. GENERAL**
- 1.2. THE APPLICANT**
- 1.3. BACKGROUND TO THE APPLICATION**
- 1.4. PLANNING STATUS**
- 1.5. AIMS OF THE ENVIRONMENTAL IMPACT STATEMENT**
- 1.6. FORMAT OF THE ENVIRONMENTAL IMPACT STATEMENT**
- 1.7. THE EXISTING SITE**
- 1.8. PROPOSED DEVELOPMENT**
- 1.9. CONSULTATIONS**
- 1.10. PROJECT TEAM**

REFERENCES

SECTION 1 – FIGURES

- Figure 1.1 Site Location Map (1:50,000)**
- Figure 1.2 Existing Site Layout (1:5000)**
- Figure 1.3 Existing Site Layout (1:5,000): Aerial Photograph**

SECTION 1 – APPENDICES

- Appendix 1-A Copy of Correspondence from the Department of Communications, Energy and Natural Resources dated 9th January 2008**
- Appendix 1-B Copy of IPPC Licence No. 521**
- Appendix 1-C S. 261 (Quarry Ref. No. QY2) – Planning Conditions & Compliance Status**
- Appendix 1-D Copies of Responses to Consultation Process**

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1.1 GENERAL

This Environmental Impact Statement (EIS) is prepared to accompany a planning application submitted to Kilkenny County Council by Roadstone Provinces Ltd. The planning application is being submitted in order to obtain permission for the proposed extension of the existing quarry (opencast mine) at Maddoxstown, Dunbell Big Townland, Co. Kilkenny, refer to Figure 1.1.

The proposed development comprises:

- Extension of the existing south-east quarry area by c.13.4 hectares.
- Provision for mobile crushing & screening of stone.
- Soil / Overburden storage.
- Landscaped screening berms and site restoration works.
- All related ancillary works.

The overall extraction rate will remain at current levels. The development will utilise the existing infrastructure in terms of access onto the local road network; offices and canteen facilities etc.

This planning application and EIS were prepared in accordance with the requirement of the following regulations:

- 1) The First Schedule of the European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999 (S.I. No. 93 of 1999);
- 2) The Planning & Development Regulations, 2001

The format and scope of this document has been produced with due regard to:

- 1) The Second Schedule and Third Schedule of the European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999
- 2) Kilkenny County Development Plan 2002.
- 3) Guidelines on the Information to be contained in Environmental Impact Statements, Environmental Protection Agency (EPA, 2002)
- 4) Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), Environmental Protection Agency (EPA, 2003).

The Environmental Impact Statement takes into account other government and commonly accepted standards and guidelines that affect the various aspects of the proposed development, including the Department of the Environment, Heritage and Local Government (DoEHLG) – *Quarries and Ancillary Activities: Guidelines for Planning Authorities* (2004) and the Environmental Protection Agency (EPA) – *Environmental Management Guidelines : environmental Management in the Extractive Industry* (2006).

1.2 THE APPLICANT

Roadstone Provinces Ltd. is a subsidiary of Cement Roadstone Holdings Plc. (CRH), the international building materials group, with more than 3,500 locations and employing over 92,000 people in 34 countries. CRH is a leading supplier of construction materials in the world with operations focusing on three closely related core businesses: Primary Materials; Value-added building products and Specialist building materials distribution.

Roadstone is a progressive manufacturer and supplier of a comprehensive range of high quality building materials and products for the construction industry in Ireland. The Company's products are manufactured at plants operating independently assessed quality assurance schemes to I.S. EN ISO 9001:2000.

To protect the environment and communities in which they operate, Roadstone complies fully with the high national and international environmental standards by using raw materials which are sympathetically sourced. Roadstone Provinces Ltd. operate their quarries in accordance with an in-house Environmental Management System (EMS) and have been accredited with ISO 14001 which relates to the implementation of an Environmental Management System.

The company is proud of its record of 50 years continuous development and service to the construction industry and the contribution it has made towards building Ireland's infrastructure and overall economy.

Roadstone Provinces Ltd. own and operate the existing quarry (opencast mine) and associated processing operation near Maddockstown, Co. Kilkenny, refer to Figure 1.1. This operation extracts mineral grade dolomite and limestone, and produces concrete, aggregates for road building, general construction and agricultural lime.

1.3 BACKGROUND TO THE APPLICATION

Roadstone Provinces Ltd's present quarry development and processing plant have been in operation for a number of years now, supplying limestone products, concrete, crushed rock, and aggregates for the local market. This is a well-established development, strategically located to serve a large local / regional market.

Arising from a review of its ongoing operations and future market conditions, Roadstone Provinces Ltd. is implementing a strategy to develop its operations at Maddoxstown and secure the business. A key element in this strategy is securing permission for the extraction of stone within the proposed extension area.

State Mining Lease

The existing quarry extracts dolomite, a 'scheduled mineral', under the Minerals Development Act, 1940. As required under the Act, permission has been obtained from the Minister to make this application, refer to correspondence in Appendix 1-A. The Applicant has an existing State Mining Lease to extract dolomite, and the extent of this lease is shown on Figure 1.2. An application has been made to the Minister to renew and extend this lease.

IPPC Licence

Environmental emissions related to the existing quarry are regulated under an Integrated Pollution Prevention and Control (IPPC) Licence issued by the Environmental Protection Agency (EPA) – Licence No. 521. The licence boundary is shown on Figure 1.2. An application has been made to the EPA for a review of this licence to include the proposed quarry extension area. A copy of the existing licence is provided in Appendix 1-B.

1.4 PLANNING STATUS

The planning status of the existing development is summarised below:

1.4.1 Existing Planning Permissions

The following planning permissions have been previously granted at the overall site for the existing quarry and ancillary facilities.

Planning Ref:	Date	Details	Applicant
1/1/1234	July 1969	Erection of buildings and utilisation of land for mining purposes at Dunbell Big, Bennettsbridge, Co. Kilkenny	Quigley Magnesite Ltd
02/1534 PL.10.201729	May 2003	Erection and operation of a concrete batching plant at existing operation at Maddockstown Opencast Mine, Dunbell Big Co. Kilkenny	Roadstone Provinces Ltd

1.4.2 Section 261 – Quarry Registration

Roadstone Provinces Ltd. registered Maddockstown Opencast Mine with Kilkenny County Council, in accordance with the requirements of Section 261 – Planning & Development Act (2000). The Section 261 Quarry Ref. No. for Maddockstown Opencast Mine is **QY2**. The Planning Authority reviewed the existing planning permission (1/1/1234) and issued a revised / modified set of conditions for the quarry operation, in accordance with sub-section 6 (a) (ii) of the Act.

1.4.3 Planning Compliance

A copy of the above planning conditions imposed by Kilkenny County Council under Section 261 of the Planning & Development Act 2000, and their compliance status are provided in Appendix 1-C.

1.5 AIMS OF THE ENVIRONMENTAL IMPACT STATEMENT

An Environmental Impact Statement (EIS) “means a statement of the effects, if any, which proposed development, if carried out, would have on the environment”. As such, it is a systematic evaluation of the positive and negative impacts of a project on both the natural and human environments. The principal objectives of an Environmental Impact Statement are to:

- 1) Identify and/or predict the significant impacts of the development;
- 2) Identify what mitigation measures should be incorporated into the development to eliminate or reduce the perceived impacts;

- 3) Interpret and communicate the above information on the impact of the proposed development, in both technical and non-technical terms;
- 4) Assist the Planning Authority in the decision making process with respect to the associated planning application.

1.6 FORMAT OF THE ENVIRONMENTAL IMPACT STATEMENT

To facilitate clarity, this report has been prepared in accordance with the ‘*Guidelines on the Information to be Contained in Environmental Impact Statements*’ (EPA, 2002). The EIS is sub divided into three parts, each with a number of sections and sub-sections. As an overview they comprise of:

- **SECTION 1.**

An introduction to the proposed development, and an explanation of the purpose of the EIS. It also identifies the various consultees and professional consultants who have contributed to this EIS.

- **SECTION 2.**

A detailed description of the proposed development, including operational considerations and final restoration schemes. It also explains the need for the proposed development, details any proposed or anticipated growth of the development and possible associated projects.

- **SECTION 3.**

Detailed information on all aspects of the existing environment, it identifies potential impacts on the environment by the proposed development, and recommends mitigation measures to reduce or eliminate these impacts. They are grouped under the following sub-sections:

- 3.1 Human Beings
- 3.2 Flora and Fauna
- 3.3 Soils (and Geology)
- 3.4 Water (surface and groundwater)
- 3.5 Climate
- 3.6 Air Quality
- 3.7 Noise and Vibration
- 3.8 Landscape
- 3.9 Cultural Heritage
- 3.10 Material Assets
- 3.11 Roads & Traffic
- 3.12 The Interaction of the Foregoing

The associated references, plates and figures are provided at the end of each section for Sections 1 and 2, and at the end of each sub-section for Section 3.

A “Non-Technical Summary of the Environment Impact Statement”, incorporating all of the above sections, is provided as a separate and self-contained document.

1.7 SITE LOCATION

The proposed development is located in the townland of Dunbell Big, c.2.5km north of Bennettsbridge and c.6.5km southeast of Kilkenny, co. Kilkenny, refer to Figure 1.1. It is located on a county road which runs north to Kilkenny and south to Bennettsbridge.

The total site area comprises approximately 116.3 hectares (c. 287.4 acres). The current planning permission (PL 10.5.11550) covers an area of approximately 75.9 hectares (187.5 acres). The proposed extension area is approximately 15.3 hectares (of which 13.4 will be extraction), refer to Figure 1.2. Access to / from the site will be via the existing county road and north onto the N10 (Dublin to Kilkenny) national primary road or south towards Bennettsbridge, refer to Figure 1.1.

The existing topography across the existing application site area varies in level from approximately 36mOD to 68mOD. Levels across the proposed application area vary from approximately 58mOD to 62mOD. The nearest significant surface water course in the vicinity of the site is the River Nore which adjoins the western boundary of RPL's land ownership, refer to Figure 1.1.

Surrounding land use generally comprises agricultural grazing, with ribbon development along the local county roads.

1.8 PROPOSED DEVELOPMENT

The proposed development consists of an extension to the existing quarry covering an area of approximately 16 hectares. Extraction will take place to a depth of -25 metres OD. The annual extraction rate will be maintained at the existing level of c.600,000 tonnes per year and will depend on market demand. Planning permission is also being sought for the provision of mobile crushing & screening of the extracted stone, soil / overburden storage, landscaping of screening berms, site restoration works, and all related ancillary works.

The existing quarry operates an ISO 14001 accredited environmental management system (EMS). The existing environmental monitoring programme and environmental management / control measures in place at the quarry will be extended to incorporate the proposed quarry extension area.

1.9 CONSULTATIONS

In preparing the planning application for the development and this Environmental Impact Statement, a pre-planning consultation document was also issued to the following parties for the purposes of EIS scoping:

- **Kilkenny Co. Council**
- **DoEHLG National Parks and Wildlife Service**
- **Southern Regional Fisheries Board**
- **An Taisce**
- **Failte Ireland**
- **The Heritage Council**
- **National Roads Authority**
- **Department of Communications, Energy & Natural Resources**
- **DoEHLG National Monuments Section**
- **Geological Survey of Ireland**

On receipt of the pre-planning document, Kilkenny Co. Council also referred it to the prescribed bodies above; Coras Iompar Eireann (CIE); Bord Gais; Irish Wildbird Conservancy; and internal sections within Kilkenny Co. Council: Roads, environment, Roads Project Office, Sanitary Services and Heritage Officer.

Responses to the pre – planning consultation documents were received from An Taisce; Failte Ireland; and the Geological Survey of Ireland. Copies of the correspondence received are provided in Appendix 1-D. Issues raised in these responses have been reviewed and addressed in the preparation of the EIS.

In addition to the consultation with prescribed bodies, Roadstone Provinces Ltd. is in continuous dialogue with the local community. Issues arising from these discussions have addressed in this application.

1.10 PROJECT TEAM

The planning application and Environmental Impact Statement has been prepared by John Barnett and Associates Ltd. (JBA), Chartered Mineral Surveyors, Environmental, Planning & Geotechnical Consultants, on behalf of Roadstone Provinces Ltd. John Barnett & Associates personnel primarily involved with this project were:

Tim Paul	Chartered Mineral Surveyor & Chartered Civil Engineer
Shane McDermott	Minerals and Land Surveyor
John Kelly	Professional Geologist
Lorraine Holland	Environmental Scientist
Sinead McDonnell	Environmental Scientist / Ecologist

Specialist sub-consultants were appointed to assess a number of environmental topics and to prepare the corresponding sub-sections in Section 3 of the EIS. These sub-consultants, together with the EIS section they prepared, are summarised below. The consultants provided their relevant sub-section in the format as it is published in this EIS. No separate reports were prepared by the sub-consultants.

Roger Goodwillie	Flora & Fauna – EIS Section 3.2
Eugene Daly Associates	Water – EIS Section 3.4
Dr. Charles Mount (ICF Project Archaeologist)	Cultural Heritage – EIS Section 3.9
WSP Ireland Ltd	Roads & Traffic – EIS Section 3.11

The following Roadstone Provinces Ltd. personnel provided relevant information and reviewed the planning application and EIS: John Glynn, John Frost, and Ronan Griffin.

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REFERENCES

1. ***European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999*** (S.I. No. 349 of 1989)
2. ***Planning and Development Regulations, 2001***
3. ***European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999***, Second Schedule, (S.I. No. 93 of 1999)
4. ***European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999***, Third Schedule, (S.I. No. 93 of 1999)
5. ***Kilkenny County Development Plan 2002***
6. ***Draft Kilkenny County Development Plan 2008***
7. ***Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)***, Environmental Protection Agency (EPA, 2003)
8. ***Guidelines on the Information to be Contained in Environmental Impact Statements***, Environmental Protection Agency (EPA, 2002)
9. ***DoEHLG Quarries and Ancillary Activities – Guidelines for Planning Authorities***
Department of the Environment, Heritage and Local Government (April 2004).
10. ***EPA Environmental Management Guidelines : Environmental Management in the Extractive Industry***. Environmental Protection Agency (2006)

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SECTION 1 – FIGURES

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SECTION 1 – APPENDICES

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APPENDIX 1-A

Copy of Correspondence from the Department of Communications, Energy & Natural Resources dated 9th January 2008

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APPENDIX 1-B

Copy of IPPC Licence (No.521)

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APPENDIX 1-C

Section 261 (Quarry Reference No. QY2)

Imposed Planning Conditions & Compliance Status

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APPENDIX 1-D

Copies of Responses to Consultation Process

An Taisce

**Department of Communications, Energy &
Natural Resources**

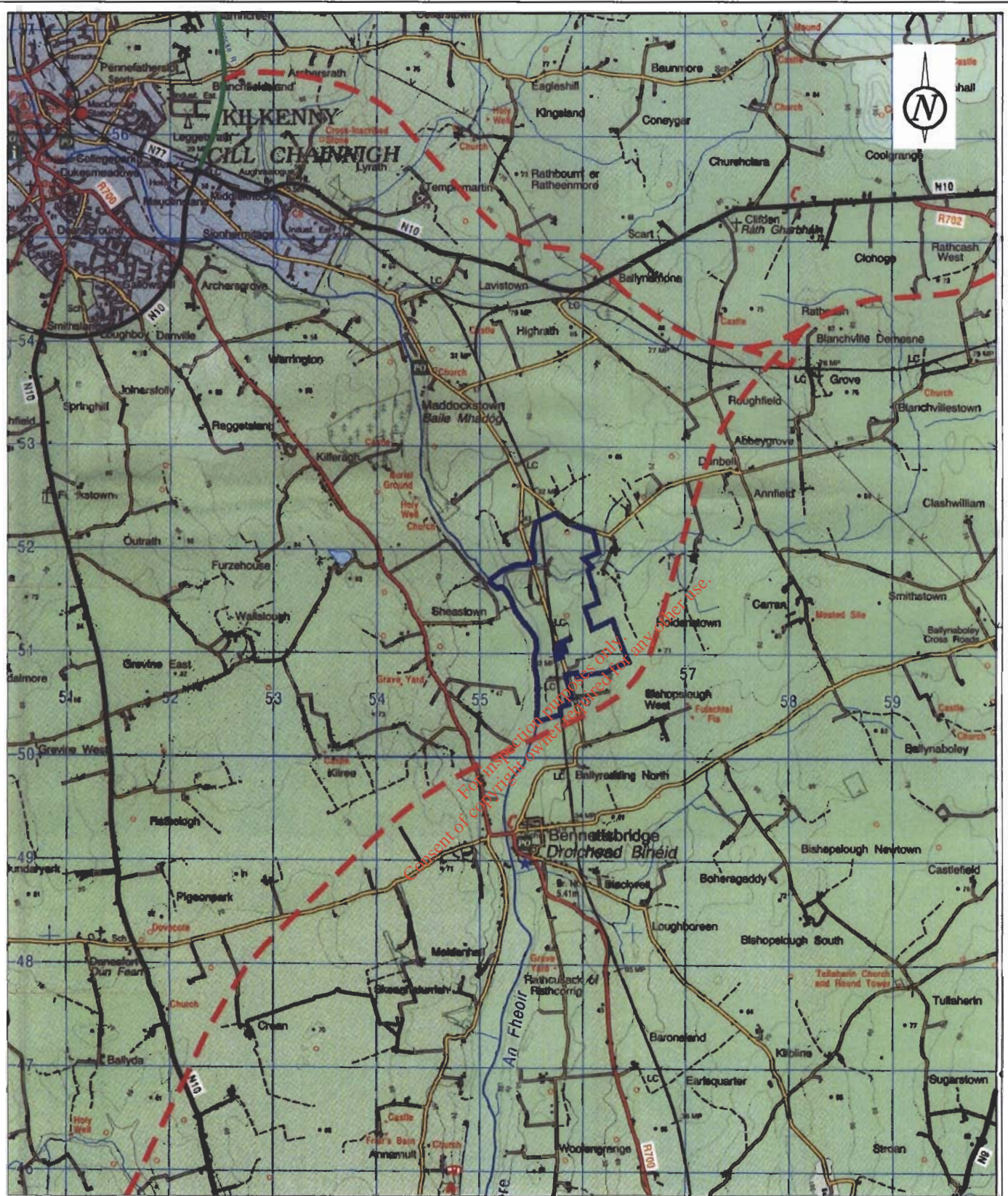
**Department of the Environment, Heritage &
Local Government: National Monuments
Section**

**Department of the Environment, Heritage &
Local Government: National Parks & Wildlife
Service**

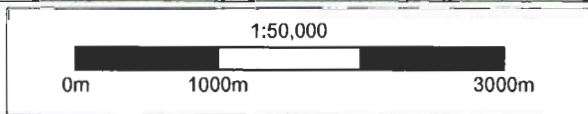
Kilkenny County Council

National Roads Authority

Iarnrod Eireann



Extract from 1:50,000 O.S. Discovery Series Map No. 67 (OS 6)

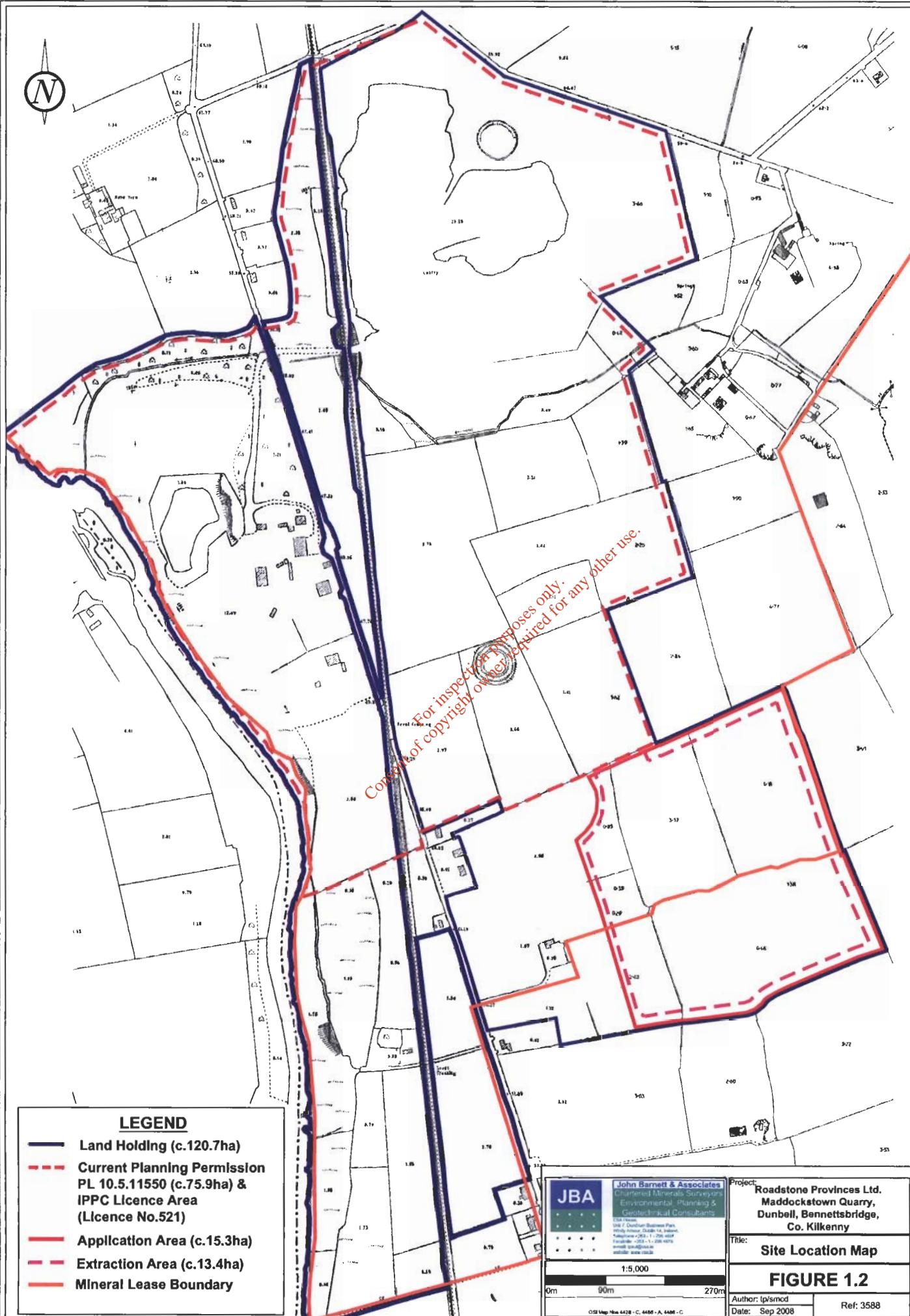


Legend

- Site Location
- N9 Dual Carriageway
(Under Construction)

Ordnance Survey Ireland Licence No. SU 0000708
(C) Ordnance Survey Ireland & Government of Ireland

	ROADSTONE PROVINCES LTD Maddoxstown Opencast Mine, Dunbell, Bennettsbridge, Co. Kilkenny LOCATION MAP	
	Author: smcd/tp Date: Sep 2008	FIGURE 1.1
John Barnett & Associates Ltd, 7 Dundrum Business Park, Windy Arbour, Dublin 14		



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LEGEND

- Land Holding (c.120.7ha)
- Current Planning Permission PL 10.5.11550 (c.75.9ha) & IPPC Licence Area (Licence No.521)
- Application Area (c.15.3ha)
- Extraction Area (c.13.4ha)
- Mineral Lease Boundary

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Project: Roadstone Provinces Ltd.
Maddockstown Quarry,
Dunbell, Bennettsbridge,
Co. Kilkenny

Title: **Site Location Map**

FIGURE 1.2

Scale: 1:5,000
0m 90m 270m

Author: ip/s/mcd
Date: Sep 2008
Ref: 3588

OSI Map No. 4428 - C, 4456 - A, 4486 - C
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-  Mineral Lease Boundary
-  N9 / N10 Dual Carriageway Under Construction

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1:5,000
0m 90m

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SECTION 2 – DESCRIPTION OF THE PROPOSED DEVELOPMENT

CONTENTS

- 2.1 THE NEED FOR THE DEVELOPMENT**
 - 2.1.1 National Context**
 - i. Construction Industry**
 - ii. National Development Plan 2007- 2013**
 - iii. National Spatial Strategy 2002**
 - 2.1.2 Regional Planning Guidelines**
 - 2.1.3 Kilkenny County Development Plan (2002)**
 - 2.1.4 Draft Kilkenny County Development Plan (2008 – 2014)**
 - 2.1.5 The Need for the Development**
- 2.2 ALTERNATIVES EXAMINED**
 - 2.2.1 Alternative Sources of Aggregates**
 - 2.2.1 Alternative Locations**
 - 2.2.2 Alternative Designs & Site Layouts**
- 2.3 CHARACTERISTICS OF THE PROJECT**
 - 2.3.1 THE EXISTING SITE**
 - 2.3.1.1 General Site Description**
 - 2.3.1.2 Operational Overview**
 - 2.3.2 THE PROPOSED DEVELOPMENT**
 - 2.3.2.1 Development Overview**
- 2.4 PRELIMINARY WORKS PHASE**
 - 2.4.1 Landuse**
 - 2.4.2 Aggregate Reserve Assessment**
- 2.5 OPERATIONAL PHASE**
 - 2.5.1 Method & Rate of Extraction**

- 2.5.2 Duration & Phasing of the Workings**
- 2.5.3 Blasting Methods**
- 2.5.4 Processing Methods**
- 2.5.5 Topsoil & Overburden Management**
- 2.5.6 Stability of the Quarry**
- 2.5.7 Fuel & Chemical Storage**
- 2.5.8 Surface Water & Groundwater Management**
- 2.5.9 Working Hours & Employment**
- 2.5.10 Transport & Access**
- 2.5.11 Offices & Facilities**
- 2.5.12 Utilities & Services**
- 2.5.13 Waste Management**
- 2.5.14 Safety & Security**
- 2.5.15 Lighting**
- 2.5.16 Progressive Restoration**
- 2.5.17 Dust Generation & Control**
- 2.5.18 Noise Generation & Control**
- 2.5.19 Environmental Management & Monitoring**
- 2.6 RESTORATION & AFTERCARE**
 - 2.6.1 Final Site Restoration Scheme**
 - 2.6.2 Long Term Safety & Security**
 - 2.6.3 Long Term Stability of the Quarry**
 - 2.6.4 Long Term Surface Water & Groundwater Management**
 - 2.6.5 Decommissioning of Plant & Machinery**
 - 2.6.6 Aftercare & Monitoring**
 - 2.6.7 Restoration Bond**
- 2.7 PROPOSED MITIGATION SUMMARY TABLE**

REFERENCES

FIGURES

Figure 2.1 Construction Output 1998 – 2007E (DoEHLG / DKM Economic Consultants, 2006)

Figure 2.2 Direct Employment in the Construction Industry: 2001 – 2007 (DoEHLG / DKM Economic Consultants, 2006)

Figure 2.3 Map 8 (National Spatial Strategy)

Figure 2.4 Regional Economic Context (1:250,000)

Figure 2.5 Existing Site Layout (1:2,500)

Figure 2.6 Proposed Site Layout (1:5,000)

Figure 2.7 Existing & Proposed Cross Sections (1:2,500)

Figure 2.8 Restoration Scheme (1:5,000)

Figure 2.9 Restoration Cross Sections (1:2,500)

Figure 2.10 Typical Section of Restored Upper Quarry Face (Bench 1) & Landscaped Screening Berm

APPENDICES

Appendix 2-A Overall Restoration Scheme / Landscape Specification

2.1 THE NEED FOR THE DEVELOPMENT

2.1.1 National and Regional Context

i. Construction Industry

An adequate steady supply of aggregates is required by the construction industry on an ongoing basis in order that it will be able to supply the economic and social infrastructure required for the modern mixed open economy that Ireland is. This is even more critical given the growth of the construction industry in the last number of years and the projected continued requirement to redress the social and economic infrastructure deficit currently experienced in the State.

The Review of the Construction Industry 2006 and Outlook 2007–2009 published by DKM Economic Consultants (2007) and funded by the Department of the Environment, Heritage and Local Government (DoEHLG) provides a review of past construction performance in 2006 and estimates future performance for the sector in the period 2007–2009. A summary is provided below.

The value of output in the construction industry in 2006 is estimated at €35.5bn compared with €31.6bn in 2005. This represents an increase of around 12% in the value of output in 2006 or an increase 5.9% in volume terms, after allowing for construction inflation, refer to Figure 2.1.1.

The value of output in the construction industry is forecast to increase to €36.2bn in 2007. The 2007 estimate represents an increase in value terms of 2.1%, which translates into a volume decline in construction output of 1.5%, after allowance is made for construction inflation. This is the first decline in overall construction output in fourteen years. The estimate for 2007 construction output represents 22.6% of GNP and 19% of GDP, when measured in gross output terms. The construction to GDP ratio is the second highest (after Spain) and compares with an average ratio of around 12% in Western Europe and less than 11% in the UK.

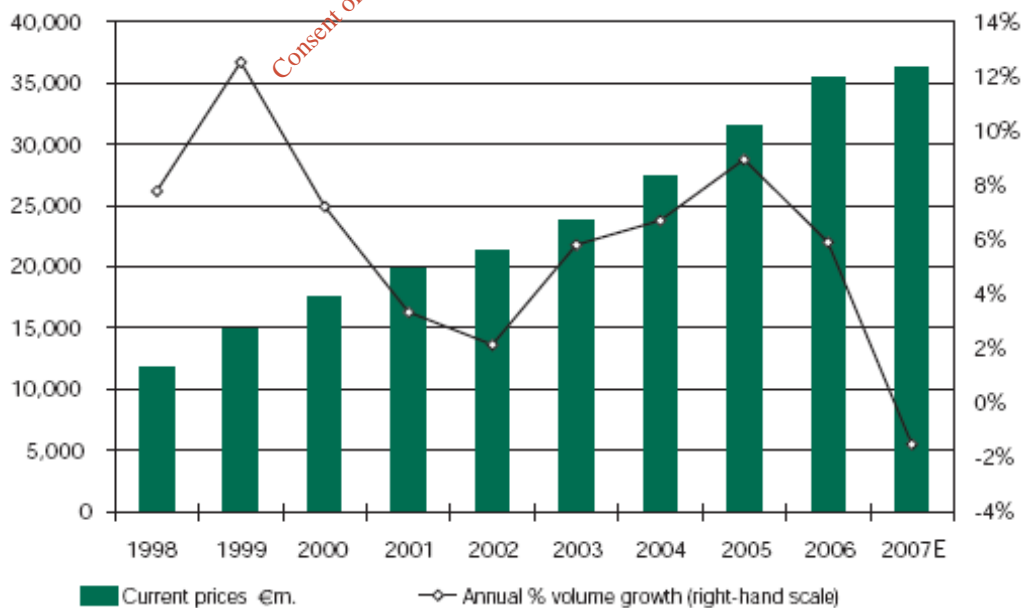


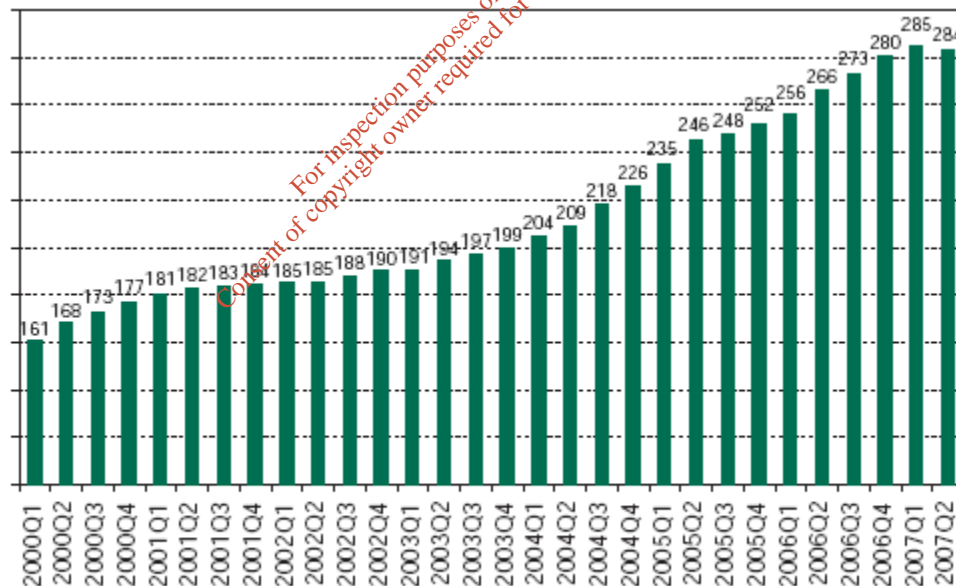
Figure 2.1.1 Construction Output 1998 – 2007E (DKM Economic Consultants, 2007)

The medium term prospects for construction will be strongly influenced by residential construction. Most of the adjustment to a lower housing supply level occurs in 2008, following the more modest downward adjustment in 2007. The easing back in term of housing supply, together with more sustainable levels of prices and lending, should give rise to a more balanced and stable market over the medium term.

There is scope to limit the impact of the contraction in residential construction over the medium term on the construction sector provided the delivery of essential infrastructure identified under the National Development Plan 2007 – 2013 is progressed in a timely and cost-effective manner.

Construction output forecasts indicate a decline (-6.2%) in 2008, due to the decline in new housing output, followed by an increase of similar proportions (+6.2%) in 2009. The recovery in 2009 reflects a stabilisation in housing output and an acceleration in the volume of construction output from civil engineering projects, most notably in public transport and airports.

Construction employment over the last decade or so has experienced sustained growth, as summarised in Figure 2.1.2 below. By Q4 2006 construction employment accounted for 13.6% of total employment across the economy, up from 10% at the beginning of the decade. These figures show that employment declined by 0.5% in Q2 2007 on the preceding quarter, to a total of 283,500. This is the first quarterly decline since Q2 2002 and follows a quarterly growth ratio of 1.7% in the preceding quarter and 3.7% just one year previously in Q2 2006.



Source: CSO, QNHS

Figure 2.1.2 Direct Employment in the Construction Industry: 2000 – Q2 2007 (DKM Economic Consultants, 2007)

The recent quarterly decline in employment Q2 2007 (in seasonally adjusted terms) can be attributed to the slowdown in new house building in the first half of 2007. There is likely to be further declines in employment in the construction sector as new house building activity weakens in 2008.

Up to 2007 it is estimated that the volume of aggregates, stone, washed sand and gravel currently being extracted was at a rate of approximately 120-130 million tonnes per year. In 1999 the volume of aggregates, stone, washed sand and gravel currently being extracted was approximately 100 million tonnes per year (KPMG, 2000). Allowing for the weakening in the new house building sector the current demand for aggregates is approximately 110 - 120 million tonnes per year. This takes account of the increase in recycling of construction & demolition waste for use as recycled / secondary aggregates. There is currently no commercial extraction of aggregates from marine sources in Ireland.

The construction materials sector needs land, albeit on a temporary basis, for the extraction of aggregates. The existing reserves at active quarries and pits are being progressively depleted by on-going extraction activity. By their nature, aggregates can only be worked where they occur. The products are generally of low unit value. The most significant cost is transportation and as a result most quarries and pits can only operate cost-effectively within up to 40 - 50 km of their market. Servicing markets outside of this radius not only increases costs but also the environmental impacts resulting from the increased haulage requirements.

2.3.2.2 National Development Plan 2007- 2013

The National Development Plan 2007 – 2013 (NDP) states that “investment in Economic Infrastructure is a key element in the promotion of competitiveness and the generation of sustainable economic growth and employment. It also contributes to regional development and assists environmental sustainability.”

It goes on to say that *“the excellent progress made under Plan 2000-2006, high levels of investment will be necessary under this Plan in the area of Transport, Energy, Communications and Environmental Services to bridge the deficits which Ireland still faces under these headings.”*

A modern and up-to-date transport network is crucial to the promotion of competitiveness and sustainable development on a national basis. A major investment in transport infrastructure has already taken place under Plan 2000-2006. This progress must now be maintained and accelerated. The current Plan has earmarked approximately €32.9 billion for investment in infrastructure over the life of the plan. Of this, €17.6 billion is ear marked for Roads, €13.0 billion for Public Transport with the remainder assigned to Air and Sea Ports.

In relation to housing the Plan notes that some €21.2 billion will be invested under the Housing Programme. This will be split between Social Housing (€17 billion) and Affordable Housing & Targeted Private Housing Support (€4 billion). Under Plan 2000-2006, it is estimated that around 480,000 new homes were built. It is expected that under the new plan 60,000 new residential units will be built per year.

iii. National Spatial Strategy

The National Spatial Strategy (NSS) was launched by the current coalition government in late 2002 and is designed to provide a framework for balanced social, economic and physical development between the regions for the next 20 years.

The Strategy notes in relation to the South East Region that;

“critical mass will be enhanced through Waterford performing as a gateway, supported by Kilkenny and Wexford as hubs”

In addition, in relation to the hubs of Kilkenny and Wexford the NSS states that;

‘The critical mass of Waterford as a gateway, supported by Kilkenny and Wexford as hubs, will be complemented by development in surrounding and adjacent towns. The

The supply of aggregates has been identified as a potential ‘bottle-neck’ to the provision of housing and other developments. It is therefore essential that Planning Authorities make adequate provision within their development plans and through development control policies to ensure the on-going availability of an adequate local supply of aggregates and construction materials.

Decentralisation Programme

Under the proposed Decentralisation programme Kilkenny City, Thomastown and Carlow Town have been selected as locations to which Dublin-based government departments may be re-located.

2.1.2 Regional Planning Guidelines for the South East Region 2004

In May 2004 the members of the South - East Regional Authority adopted the Regional Planning Guidelines for the South - East Region (Carlow, Kilkenny, South Tipperary, Waterford and Wexford). The principle objective of the guidelines is to: *‘achieve a better spatial balance of social, economic, and physical development throughout the region’*

The only explicit reference to Minerals / Aggregates in the guidelines is provided in Section 6.5.4 – Mineral Exploitation which states:

‘It is recognised that the managed exploitation of mineral and aggregate deposits is necessary for the continued economic development of the region. Local planning authorities shall, through the development plan process, assess the potential of their functional areas with regard to the economic exploitation of mineral and aggregate deposits having regard to the environmental and social impact of such operations. Planning authorities will then adopt appropriate policies to safeguard viable unworked deposits for future extraction.’

2.1.3 Kilkenny County Development Plan (2002)

The current county development plan (Kilkenny County Council, 2002) sets out the planning authority’s policy for the extractive industry, as follows:

Section 8.4 – Extractive Industries:

‘The Council recognises the importance of extractive industries to the local and national economy as valuable sources of raw material for industry in general and the construction industry in particular and as an important source of employment. The products are the essential building materials for the provision of housing and infrastructural projects.

The industry is therefore essential to the continued development of the county and the achievement of the objectives in the National development Plan. However the industry can have serious detrimental impacts on the landscape and amenities generally. It can create conflicts with other land uses such as agriculture and can cause damage to the public road network’

8.4.1 Policy.

a) In general it will be the policy of the Council to encourage the development of extractive industries where it is compatible with the protection of the landscape, the continued operation of agriculture and the preservation of amenities generally.

b) It will be the policy of the Council to ensure that all existing and new extractive industrial development shall be administered and completed in a manner which will minimise long term environmental damage to the environment.

c) It will be the policy of the Council to ensure that all existing workings shall be rehabilitated to suitable land uses and that all future extraction activities will allow for the rehabilitation of pits and proper land use management'

2.1.4 Kilkenny County Development Plan (2008 – 2014)

The current county development plan (Kilkenny County Council, 2002) is currently under review. A draft plan in existence for the period 2008 – 2014 has been published, but this plan has not been formally adopted.

The draft CDP (2008-2014) sets out the planning authority's policy for the extractive industry for the future, as follows:

Section 6.3.3 – Extractive Industries:

"The County has a large lead-zinc deposit at Galmoy. In addition there are numerous sand and gravel and stone resources within the County currently in operation. The Council recognises the importance of extractive industries to the local and national economy as valuable sources of raw material for industry in general and the Construction Industry, in particular and as an important source of employment. The products are the essential building materials for the provision of housing and infrastructural projects. The industry is therefore essential to the continued development of the county and the achievement of the objectives in the National Development Plan. However the industry can have serious detrimental impacts on the landscape and amenities generally. It can create conflicts with other land uses such as agriculture and can cause damage to the public road network. Because the extraction industry is a very significant industry serving the construction, industrial and energy sectors, it is important to facilitate development, particularly by safeguarding mineral reserves so that inappropriate development does not occur in the vicinity and cause difficulties in exploiting the resource. The Council will therefore seek to safeguard these valuable resources for future extraction."

POLICY

- Where important mineral resources have been identified and are suitable for extraction, the Council will seek to prevent incompatible land uses in the vicinity of these resources which could be located elsewhere and limit their future exploitation*
- In general encourage the development of extractive industries where it is compatible with the protection of the landscape, the continued operation of agriculture and the preservation of the amenities of local residents generally.*
- To minimise environmental and other impacts of mineral extraction through rigorous application of licensing, development control and enforcement requirements for quarry and other developments with particular regard to visual impacts, methods of extraction, noise levels, dust prevention, protection of ground and surface waters, impacts on residential and other amenities impacts on the road network (particularly with regard to making good any damage to roads), road safety, phasing, re-instatement and landscaping of worked sites.*
- Ensure that all existing workings shall be rehabilitated to suitable land uses and that all future extraction activities will allow for the rehabilitation of pits and proper land use management.*

2.1.5 Need for the Development

The Department of the Environment, Heritage and Local Government (2004) guidelines for planning authorities on quarrying and ancillary activities state that:

“there will be a continuing need for new or expanded aggregate quarrying operations on land to meet regional and local requirements. There is thus a need to identify and protect aggregate resource areas through the planning system, to ensure adequate supply of aggregates to meet the likely scale of future demand whilst at the same time protecting Ireland’s natural and cultural heritage.”

In addition, the Regional Planning Guidelines for the South East Region state that:

“It is recognised that the managed exploitation of mineral and aggregate deposits is necessary for the continued economic development of the region. Local Authorities shall, through the development plan process, assess the potential of their functional areas with regard to the economic exploitation of mineral and aggregate deposits having regard to the environmental and social impact of such operations.”

Furthermore, the Kilkenny County Development plan states that:

The Council recognises the importance of extractive industries to the local and national economy as valuable sources of raw material for industry in general and the construction industry in particular and as an important source of employment. The products are the essential building materials for the provision of housing and infrastructural projects. The industry is therefore essential to the continued development of the county and the achievement of the objectives in the National Development Plan

Therefore, the importance of extractive industries to the local and national economy is recognised in national, regional and local planning policy and that this policy states that the industry is essential to the continued development of the county and the achievement of the objectives of the National Development Plan.

Aggregates are a tied resource – they can only be worked where they occur, and this is a major constraint in the location of quarries. Development of the proven dolomite / limestone reserves (refer to Section 3.3 Geology) at Maddockstown are required to continue to supply the Applicant’s existing concrete manufacturing facilities on site and to supply crushed stone products to the regional market they have built up over the past 20 years.

Arising from a review of its ongoing operations and future market conditions, Roadstone Provinces Ltd. is implementing a strategy to develop its operations at Maddockstown and secure the business in the medium to long term. A key element in this strategy is securing permission for the extraction of stone over the long term.

The locations of existing quarry developments, including hard rock quarries, dimension stone quarries, sand & gravel pits and mines within 25km of the Maddockstown Quarry (Opencast Mine) development are shown on Figure 2.4. There are two other limestone aggregate quarries located in Co. Kilkenny, neither of which are owned or operated by the Applicant. The continued development and operation of this quarry is critical to Applicant’s overall development strategy in the south-eastern region of Ireland.

2.2 CONSIDERATION OF ALTERNATIVES

In the consideration of alternatives below, the issues of alternative sources of aggregates, alternative site locations, and alternative designs / methods are assessed below.

2.2.1 Alternative Sources of Aggregates

In the medium term there are no real alternatives to the current land-based sources of construction aggregates.

The demographic spread of the population, results in few large urban centres generating sufficient volumes of suitable construction and demolition (C & D) waste to supply significant volumes of recycled / secondary aggregates.

For 2006, the Environmental Protection Agency has reported that the collected C & D waste stream typically comprised 83% soil and stones (13.9 million tonnes) and 17% concrete / rubble, wood, glass, metal and plastic (2.9 million tonnes). Of this 16.8 million tonnes total volume, approximately 13.4 million tonnes was recovered. However, it should be noted that very little of this recovered soil and stone material would have been suitable for use as construction aggregates, and most of the recovered material would have been used in the restoration of poorly drained lands to agriculture or for daily cover / capping materials in existing landfill facilities. If conservatively, (from the aggregate supply perspective) 50% of the annual recovered C & D waste stream (13.4 million tonnes) is considered suitable for reuse as secondary aggregate (6.7 million tonnes) this would represent less than 5% of the overall annual aggregate demand (130 – 140 million tonnes).

Nationally, in the longer term (5 - 10 years), there may be scope for extraction of marine aggregates. Development of a future marine aggregates supply is currently constrained by the lack of an appropriate regulatory framework.

In the absence of a significant increase in the sources of recycled / secondary and marine sources, it is clear that land-based deposits (such as the proven limestone reserves at Bennettsbridge) will continue to be the main source of construction aggregates to Kilkenny city and the surrounding region.

2.2.2 Alternative Locations

The current planning application is for extension of the existing established quarry. The alternatives available to the Applicant relate to:

- i) Extension of the existing established quarry.

Or
- ii) Development of a new 'Greenfield' quarry in the area, to serve the established clients and markets in this region.

At the current time, there are no alternative quarry locations available to the Applicant in the area. It is generally accepted that the overall timeframe for development of a 'greenfield' quarry site (from initial site selection, land acquisition, preparation of a planning application and accompanying EIS, through planning process and site development to extraction of aggregates) takes between 5 and 10 years.

Notwithstanding the above, extension of the existing quarry would be beneficial in planning terms by eliminating the need for:

- Extracting additional materials from other quarries within the county, should the Applicant be unable to develop a new 'greenfield' site in the event that the existing quarry ceases operation. This would result in faster depletion of aggregate resources at these other quarry locations and potentially result in future intensification of those operations.
- Development of a 'greenfield' site at some other location within the county where there is little or no previous extractive industry landuse.
- Haulage of materials by road from other quarries within, and outside the county, with potentially longer haulage distances and increased traffic levels on the wider road network.

The development at Maddockstown Quarry will provide for continued extraction from a proven aggregate resource within an established quarry operation, with no significant increase in environmental emissions (as it is proposed not to exceed the existing extraction levels).

On the basis of the above, it is considered that extension of the existing quarry at Maddockstown, subject to continued implementation of good environmental management practice and compliance with appropriate planning controls (i.e. planning conditions and standard emission limit values for the sector) is preferable in an overall planning context, compared to the development of a new 'greenfield' quarry at some alternative location in County Kilkenny.

2.2.3 Alternative Designs / Methods

A number of alternative designs and layouts have been considered during the planning and design of the proposed development, in particular:

- Extraction: depth and plan extent of the workings, direction of extraction etc.
- Fixed vs. mobile crushing & screening plant

2.3 CHARACTERISTICS OF THE PROJECT

2.3.1 The Existing Site

2.3.1.1 General Site Description

The site is located within the townland of Dunbell Big, approx. 2.5 km to the north of Bennettsbridge, and c.6.5 km southeast of Kilkenny City. The landholding comprises c.116 hectares (c.286.6 acres) of lands. The site location is shown on Figure 1.1. The site is located on a county road which runs north to Kilkenny and south to Bennettsbridge. The Waterford to Dublin railway line also bisects the site in a north – south direction. The River Nore forms the western landholding and site boundary.

The proposed extraction area is located on the eastern side of the public road and railway line. The topography slopes down from east to west towards the River Nore and public road. Ground levels over the area range from c.68mOD along the eastern site boundary to c.56mOD at the public road to c.35mOD along the western site boundary and the river Nore. The general ground levels over the proposed extraction area vary between 68mOD and 64mOD. The existing quarry layout is shown on Figure 2.5.

There are few residences in the immediate vicinity of the site boundary. Most residences comprise isolated farm dwellings and of owner occupied bungalow/residences (Refer to Figure 1.3 and 3.1.1). There are no large residential settlements within 1km of the site.

Access to the site is via the existing local road onto the Regional R700 Kilkenny to New Ross road – refer to Figure 1.1 and Section 3.11 Roads and Traffic for an assessment of the road / traffic issues. The lands comprise agricultural grazing land; – refer to Section 3.2 Flora and Fauna.

2.3.1.2 Operational Overview

The proposed quarry extension development is for extraction of limestone using conventional blasting techniques and processing of rock using mobile crushing and screening plant located within the quarry. The overall extraction rate will remain at the current level of c.600,000 tonnes per year depending on market demand. External traffic will continue to use the existing permitted quarry entrance, which will be upgraded to provide visibility in accordance with current road design standards, refer to Section 3.11.

The crushed and screened rock will then be either transported internally by HGV to the concrete manufacturing facility located within the existing site at Maddockstown or transported directly from the site as various crushed stone products across the region. No additional ancillary facilities such as canteen, office and washroom facilities will be provided as part of this application as these facilities are already in place within the overall site.

2.3.2 The Proposed Development

2.3.2.1 Development Overview

Overburden removed to form the internal access road and to access the underlying rock will be used to construct screening berms or stored temporarily within overburden areas – refer to Figure 2.6. The quarry will be developed in a series of 6 c.15m benches down to a final depth of -25m AOD (refer to Figures 2.6 and 2.7). Access to and from the quarry extension will be via the existing site entrance via the local road network to the N10 National Primary Road to the north and the R700 Regional Road to the south, refer to Section 3.11 Roads & Traffic.

Mitigation measures to alleviate any adverse impacts from the development on the environment have been incorporated into the design (Refer to Section 2.5.2 and Section 3) to ensure that the development can be operated within accepted thresholds for this type of development.

2.4 PRELIMINARY WORKS PHASE

2.4.1 Landuse

The lands comprise agricultural fields (grazing lands), refer to Section 3.2.

The economy in the area surrounding the application site is primarily agriculture based and incorporates a range of activities including livestock and dairy. Rock extraction and processing are also established practices at the existing Maddockstown opencast mine.

2.4.2 Aggregate Reserve Assessment

A detailed geophysical and geological drilling programme has been undertaken to determine the extent and quality of the aggregate resource. Rotary Core boreholes along with geophysical testing in the extraction area indicate that overburden thickness averages 3.8m, with a maximum thickness of 13.8m and a minimum of 0.3m.

The current extraction area at Maddockstown Quarry is developed within dolomitised limestones of the Butlersgrove Formation. In the northern part of the existing extraction area, and the old workings located to the west of the road and railway, the dolomites are largely composed of coarse, pale cream, pink or buff coloured dolomites (which are dark grey where the original limestone had an argillaceous component).

Review of existing quarry faces and relevant boreholes indicates that the proposed southern extraction area is underlain by either dolomites overlying limestones with minor dolomitised limestone, or limestone with minor dolomitised limestone.

Based on the results of the geological assessment an area of workable aggregate reserves was identified. A preliminary quarry design was undertaken based on developing the quarry to a datum of -25m AOD in a series of c.15m benches.

It is anticipated at the current time that the proposed quarry development will extract an average of c. 600,000 tonnes per annum. At this rate of extraction the projected life of the quarry extension would be c.34 years (a further 2 years would be required to complete restoration proposals).

A detailed topographical survey of the site was undertaken (refer to Figure 2.5). The survey data was used to produce a 3D digital terrain model using a quarry design software package called LSS. In preparing the design, standard criteria were adopted with regard to face heights and bench widths, stand offs to the site boundaries etc. (refer to Figures 2.6 & 2.7).

The volume of in-situ limestone rock to be excavated at the proposed site is based on an average of 3.8m cover of soil and overburden, and a rock density of 2.6 Mg / m³. An annual extraction rate of c. 600,000 tonnes was also assumed. The resulting overburden volume, extractable aggregate reserves and quarry life are detailed in Tables 2.2 and 2.3 below.

Bench / Extraction Depth	Area: Existing Permitted Area m³	Area: Existing Permitted Area Tonnes	Area: Extension Area (Application Area) m³	Area: Extension Area (Application Area) Tonnes
Topsoil / Overburden	90,000	180,000	450,000	900,000

Table 2.2: Overburden Volumes

Bench / Extraction Depth	Area: Existing South East Quarry m³	Area: Existing South East Quarry Tonnes	Area: Extension Area (Application Area) m³	Area: Extension Area (Application Area) Tonnes
Bench 1 to 50mOD	185,000	480,000	1,185,000	3,080,000
Bench 2 to 35mOD	235,000	610,000	1,600,000	4,160,000
Bench 3 to 20mOD	175,000	455,000	1,750,000	4,550,000
Bench 4 to 5mOD	-	-	1,000,000	2,600,000
Bench 5 to – 10mOD	-	-	1,175,000	3,055,000
Bench 6 to – 25mOD	-	-	1,050,000	2,730,000
Total	595,000	1,545,000	7,760,000	20,175,000

Table 2.3: Quarry Reserves and Life

	Area within Existing Planning Permission Area (P. Ref. 1/1/1234)
	Phase 1 12 years
	Phase 2 12 years
	Phase 3 10 years

Refer to Figure 2.7 for Colour Coded Cross Sections

It is considered that planning permission for the proposed quarry should be commensurate with life of the reserves. This will ensure the developer has security for his investment and that the operation is carried out in accordance with proper planning and development guidelines, including full implementation of the restoration proposals for the site. An adequate quarry life is required to secure an acceptable return on investment, when the costs of investment in the site development, mobile crushing / screening plant and the on-going operational costs are considered.

Section 4.9 Life of planning permissions: Quarries and Ancillary Activities – Guidelines for Planning Authorities (DOEHLG 2004) states that “*where the expected life of the proposed quarry exceeds 5 years it will normally be appropriate to grant permission for a longer period (such as 10 - 20 years), particularly where major capital investment is required at the outset. In deciding the length of the planning permission, planning authorities should have regard to the expected life of the reserves within the site*”.

As shown on Table 2.3, the quarry life is approximately 34 years. This is based on an extraction rate of c. 600,000 tonnes per annum. A further 1 – 2 years will be required for restoration and associated aftercare. On this basis, the Applicant requests planning permission for a duration of 36 years.

The Applicant proposes a condition similar to the wording of a planning condition for a quarry in Mayo (P04/1843):

‘The permission shall be for a period of 36 years (including 2 years for restoration). A programme of works for the quarry will be submitted to the council at ten yearly intervals. The council will review the programme of works and advise of any planning issues to be addressed, if required’

This will provide security to the applicant on their substantial investment and enable the Local Authority to review the development at regular intervals.

2.5 OPERATIONAL PHASE

2.5.1 Method & Rate of Extraction

It is proposed to utilise a mobile crushing and screening system within the proposed development. Further processing, if required, will take place at the existing fixed processing plant located within the overall site. There are a number of stages to the extraction process, which will occur on a progressive basis as the quarry is developed. They are:

- 1) Removal of topsoil and overburden to either screening embankments or overburden storage areas.
- 2) Drilling and blasting of the in-situ rock.
- 3) Loading of the blasted rock at the face to a mobile crushing unit by a hydraulic excavator or front end loader. The mobile crusher discharges to a screening plant which grades and stockpiles the stone into various product sizes.

2.5.2 Duration and Phasing of the Workings

The proposed quarry extension will be worked in a phased manner consisting of six benches and three phases as indicated on the working scheme in Figure 2.6 and Table 2.3 above. Cross sections through the site are shown on Figure 2.7.

Topsoil will be stripped from the extraction area and placed in temporary stockpiles. Then any overburden material will be stripped and utilised to construct the perimeter screening berms and overburden mounds as shown (Refer to Figures 2.6 and 2.7, section 2.5.5 and Appendix 2.1). They will also be immediately covered with the topsoil that was stockpiled separately, and vegetated with suitable native species. Consequently they will provide screening / security of the workings at the earliest opportunity.

The initial quarry development within the extension area will advance in a southerly direction and will provide for the natural extension to the existing quarry extraction area to the north, refer to Figures 2.6 and 2.7. This southerly direction of working will also screen the advancing working faces from the residences located to the south of the proposed extension area.

Phase 1 of the development will see extraction take place to a depth of c.35mOD or two benches below the existing ground level. The duration of this phase will take approximately 12 years. Phase 2 of the development will consist of extraction to a depth of c.5mOD, a further two benches below Phase 1. Phase 2 is expected to take approximately 12 years. The third and final phase of the proposed development will consist of extraction to a depth of -25mOD, a further two benches below Phase 2. The duration of this final phase is expected to take approximately 10 years, refer to Figures 2.6 and 2.7.

Each of the three phases will consist of two benches being worked simultaneously in a southward direction. Phases 1 and 2 will be carried out within the existing permitted area, P. Ref. 1/1/1234 and PL.10.5.11550 (illustrated as Area A on Figure 2.5) and the proposed extension area (illustrated as Area B on Figure 2.5). Phase 3 will be carried out solely within the proposed extension area, refer to Figures 2.5, 2.6 and 2.7.

It is proposed to restore the upper quarry faces in a progressive manner as the quarry is developed south. Development of the benches is effectively below ground and therefore not open to view from outside the lands.

The existing site entrance onto the county road will continue to be used. HGV traffic from the proposed extension area will utilise existing internal access roads to transport material to the on-site concrete batching plant and for transportation of aggregates off site. The existing entrance is already provided with a dust free surface from the entrance to the weighbridge / wheelwash to prevent carryout of material onto the public road. The existing entrance will be upgraded to provide adequate visibility in accordance with current road design standards (refer to EIS Section 3.11).

A drilling contractor will be mobilised to site as and when required to undertake drilling operations. The operator will ensure that the drilling contractor uses a drill rig that is properly maintained and is fitted with adequate noise suppression and dust control / extraction equipment to reduce any impact arising from drilling operations.

There are 10 dwellings within 500m of the proposed quarry extension area, and those that are, are located along the County road to the west, north and south of the proposed extraction area as shown by Figure 3.1.1. A number of residences have potential views towards the site, however, these views are limited, being largely screened by intervening sloping land, maintaining the existing ridgeline and hedgerows which will be reinforced where required and the provision of a landscaped screening berm (Refer to EIS Section 3.8 - Landscape).

2.5.3 Blasting Methods

The rock will be fragmented using industry standard blasting procedures that are currently implemented by Roadstone Provinces at Maddockstown and other quarry operations. The objectives of these procedures are to:

- 1) ensure safety of all persons and property;
- 2) minimise the vibration and air overpressure;
- 3) to allow prediction of vibration levels at given locations;
- 4) efficiently extract rock from the quarry face;
- 5) minimise the amount of explosives used.

Blasting procedures and a description of any potential environmental impacts, mitigation measures and monitoring of blasting operation is provided in Section 3.7 – Noise and Vibration.

2.5.4 Processing Methods

Blasted rock will be loaded by excavator or front-end loader to the mobile crushing and screening plant located within the quarry extension area. The crushing and screening operation will comprise primary and secondary stages to produce the range of sizes required. The aggregates produced will then be stockpiled and subsequently loaded out by a front-end loader to road trucks for transport off site. A significant advantage of using mobile crushing and screening equipment is that the plant can be located close to the working face thereby reducing the impact of the plant with respect to dust, noise and visual intrusion.

2.5.5 Topsoil & Overburden Management

Depending on the stage of the development, topsoil and overburden will be placed according to one of the following options. They are detailed in order of priority:

- 1) Within the perimeter security / screening embankment of the site. This is to allow the vegetation of these screening embankments as soon as possible – refer to Figure 2.6.
- 2) Directly on completed sections of the quarry face as part of the final quarry face restoration (Refer to Figure 2.11).
- 3) Within the designated overburden storage area to be located within the existing quarry void.

2.5.6 Stability of the Quarry

Based on the available geological information, it is proposed to adopt the following final slope angles for the quarry:

- | | | | |
|-----|---------------------------|--------|---------------------------------------|
| i. | Overburden (glacial till) | <1:1.5 | (approximately 35° to the horizontal) |
| ii. | Rock | 5.5:1 | (approximately 80° to the horizontal) |

The proposed working scheme for the quarry has incorporated these slope angles. Typical bench heights will be 15 metres and meet the requirements of the Safety, Health & Welfare at Work (Quarries) Regulations, 2008.

2.5.7 Fuel Storage

The development will use the existing fuel storage facilities located adjacent to the existing site entrance as indicated on Figure 2.6. Refuelling of machinery, i.e. the mobile crusher and excavator will take place within the proposed extension area using a double skinned mobile fuel bowser.

All petroleum products and chemicals within the existing development are stored in paved and bunded areas. In particular all diesel tanks are set upon concrete standings and potential spillages are contained within a bund wall with a minimum capacity of 110% of the total tank(s) volume.

- All waste oils and chemicals will be stored inside a bunded area and disposed of off-site by a specialist licensed contractor;
- Refuelling and maintenance of plant will be conducted in a designated servicing and refuelling area as stated above;
- Surface run-off and ground water ingress will be managed on site;
- Refer also to section 3.4 – Surface and Groundwater for mitigation measures.

2.5.8 Surface Water & Groundwater Management

Surface water and/or groundwater drainage within the extraction area will be managed within the existing water management system that is regulated under the existing IPPC Licence, refer to EIS Section 3.4.

2.5.9 Working Hours & Employment

It is intended that the proposed development will be operated during the hours of 06:00 to 20:00, Monday to Friday and from 06:00 hours to 18:00 hours on Saturday in line with the existing development operational hours. The quarry will not operate on Sundays or public holidays. As shown in Section 3.7 loading activities at the quarry can comply with a 45 dB(A) nighttime level.

The proposed development will create continued employment for a work force of c. 40 personnel including direct employees, sub-contractors (e.g. drilling and blasting), contract hauliers, maintenance contractors, material suppliers, etc. **[JG to confirm]**

2.5.10 Transport & Access

The haulage routes from the site will be via the existing local road network with the main route onto the R700 Kilkenny to New Ross road at Bennettsbride to the south of the site or onto the N10 at Kilkenny City to the north of the site. This and other haulage routes are described in more detail in Section 3.11.3.

The predicted heavy goods vehicle (HGV) traffic flow generated by the development is in line with existing traffic movements at the site, being c.220 truck movements (includes In and out) per day to and from the site.

An existing wheel wash facility is in place and operational adjacent to the site office and entrance (Refer to Figure 2.7). The wheelwash is located close to the weighbridge, thereby ensuring that all trucks leaving the site have to exit through the wheelwash. The access road is an asphalt surface from the site entrance to the wheelwash and weighbridge which helps to reduce noise and dust associated with trucks using the site entrance. The provision of a weighbridge ensures that no trucks leave the site overloaded (Refer to Figure 2.7).

The existing main entrance has a lockable steel gate to ensure security of the site.

2.5.11 Offices & Facilities

Existing on site facilities include a weighbridge, wheelwash, site office, canteen and toilet facilities which will continue to be utilised by staff members, refer to Figures 2.5 and 2.6. Water for drinking and to service the toilet facilities (located within the site office) is supplied from an existing bored well.

2.5.12 Utilities & Services

There are no utilities or services crossing the proposed extension extraction area. An established ESB connection is in existence at the site which will provide for any power supply requirements associated with the extension development.

2.5.13 Waste Management

Any excess material arising as part of the extraction process (e.g. topsoil / overburden / extremely weathered bedrock) will be utilised in the restoration process.

Waste oils, batteries, scrap metal etc., will be removed from site for recycling by approved specialist licensed contractors. A licensed waste collection contractor will remove any domestic waste requiring disposal to a licensed waste management facility which is currently the case at the existing quarry development and documented in the company's existing ISO 14001 accredited Environmental Management System (EMS) for the site

2.5.14 Safety & Security

The following barrier system will be put in place in the interest of public safety and to prevent public access to the quarry. (Refer to Figure 2.11).

The barrier system is as follows

- Overburden from future extraction will be used to construct a 5 metre high berm at the perimeter of the proposed excavation. The landscaped and planted embankment will form a substantial physical barrier to access to the excavation. It will also provide additional screening from outside views.
- The proposed site area shall be fenced in accordance with the Mines & Quarries Act. All necessary warning signs will be displayed at visible locations along the boundary at appropriate intervals.
- 9 Hawthorn plants per metre run, in two rows at 250mm spacing will be planted which will eventually form a dense, impenetrable barrier.
- 2 rows of boulders of c.1m diameter will be placed inside the embankment to form a further permanent hurdle.

The growth of vegetation on the berm over time will create a thick, virtually impenetrable hedgerow around the site. This, in conjunction with the other barriers, is considered sufficient to prevent accidental access to the quarry workings.

The existing trees and hedgerows on the site perimeter will be retained, and if necessary reinforced, for the duration of the workings. Any gaps in the existing boundary which would provide uncontrolled access to the proposed quarry will be blocked by a suitable means and reinforced with further planting as necessary and / or fenced.

In order to prevent unauthorised vehicular access, the existing site entrance has a lockable steel gate which remains closed and locked outside normal working hours (refer to *Section 2.5.9 - Working Hours and Employment*).

2.5.15 Lighting

For the short periods when the operation will be working into darkness (i.e. over winter months), the operators will ensure that sufficient lighting is provided for safe operations. As most quarry activity is below surrounding ground level light pollution from site activity will be minimal.

Lighting will be provided for the mobile plant to ensure safety of all.

2.5.16 Progressive Restoration

The rock will be excavated in six c.15m benches. A phased restoration plan will be implemented to minimise the extent and duration of the final restoration works.

Progressive restoration allows vegetation to become established during the course of the development, thereby reducing the overall impact of the development (i.e. visual impact, dust impact, flora and fauna impact etc.). It also has the added benefit to the operator of spreading out the cost of restoration over the life of the development (refer to Figures 2.8 & 2.9).

Grading and planting on completed sections of the upper quarry face will be carried out as shown by Figure 2.10. The upper benches will be seeded with suitable species of shrubs and climbers to create vegetated ledges. Vegetation and natural colonisation on these benches will encourage growth on the faces and will subsequently break up the natural harshness of the exposed rock face. This will occur in a progressive manner as quarrying advances. Refer to Appendix 2.1 for Overall Restoration Scheme. Commencement of restoration can only be facilitated when the upper faces reach their extraction limits.

2.5.17 Dust Generation & Control

Quarrying activities and ancillary facilities by, their nature, generate dust. The dust arises predominantly from inert soil and rock materials.

Dust generation occurs from three main sources.

- 1) Point sources – such as operating plant and machinery
- 2) Line Sources – such as roads and conveyors
- 3) Dispersed Sources – such as topsoil stripping, quarry floors and stockpiles of fine materials.

The main potential sources of dust include processing plant, stockpiles of fine materials, traffic on internal haul roads, stripping and placement of overburden. They are generally dispersed sources rather than specific point sources, and this dictates the measures required to mitigate potential dust related impacts.

Emission of fugitive dust from point sources such as the in-pit crushing plant will be minimised by utilising in-pit water for dust suppression. The amount of dust produced from excavating machinery is minimal.

Water collecting in the quarry will also be used to suppress dust on haul roads and quarry floors through the use of a water bowser fitted with spray bars.

Dust generation from dispersed sources such as topsoil stripping and stockpiles will be reduced by:

- 1) Ensuring stripping of topsoil / overburden material generally does not occur during summer months, when dust generation is at its peak. The optimum period for stripping is spring or autumn.

2) Topsoil and overburden embankments will be constructed with relatively low slope angles (maximum 1:1.5 – approximately 35° to the horizontal) to reduce wind turbulence along their surface. They will be re-vegetated as quickly as possible and irrigated by water bowser where necessary.

2.5.18 Noise Generation & Control

The sources of noise within the quarry will primarily be from machinery operation and blasting of rock. The type of noise generated and the mitigations implemented to reduce it are detailed below:

Mobile Machinery

Plant and machinery used at the site will either be diesel or electric powered. In order to reduce noise emitted from these machines as much as possible.

- All machinery used will be CE certified for compliance with EU noise control limits.
- The machinery will be regularly serviced and maintained. This includes regularly checking any muffler systems and servicing or replacing as required. It will also ensure any loss or damaged panels or covers that suppress noise are fixed or replaced immediately.
- If there are further noise-reducing modifications for any machinery, they will be fitted wherever practical (e.g. rubber – decked screens, rubber chute linings etc.)
- Ramp grades will be kept as low as possible (1:10) to reduce engine / brake noise from heavy vehicles.
- Working areas will be screened using earth embankments.
- All processing and loading operations will be on the quarry floor (screened by quarry face).

Noise levels arising from the quarry extension will comply with the threshold limits specified in the existing IPPC Licence for the overall development.

On site activities should be permitted during night-time hours where they comply with the noise emission limit values (e.g. loading of materials).

Blasting

Refer to Section 2.5.3 and Section 3.7 – Noise and Vibration

2.5.19 Environmental Management & Monitoring

Environmental Management System (EMS)

Roadstone Provinces Ltd. operate their quarries in accordance with an in-house Environmental Management System (EMS) and have been accredited with ISO 14001 which relates to the implementation of an Environmental Management System.

Environmental Monitoring Programme

The Applicant has an existing environmental monitoring programme in place at the site, under the existing IPPC Licence. This monitoring programme includes:

- Groundwater
- Discharge water quality

- Noise
- Blasting
- Dust deposition

The monitoring results are submitted to the EPA on a quarterly basis. The scope of the monitoring programme will be revised to incorporate the proposed quarry extension area, refer to EIS Sections 3.6 and 3.7.

2.6 RESTORATION & AFTERCARE

2.6.1 Final Site Restoration Scheme

Restoration of the proposed site will be carried out in a progressive fashion over the life of the operation. Stockpiled overburden will be utilised on the worked out upper bench to allow for planting and recolonisation to be carried out as soon as possible to restore the void to a dedicated amenity and nature reserve area. Groundwater will be allowed return to its natural level c.45mOD to 50mOD. Refer to Figures 2.8 & 2.9 and Appendix 2.1 for Landscape Plan/Overall Restoration Scheme.

Redundant plant equipment and stockpiles will be removed from site on cessation of quarry activity.

2.6.2 Long Term Safety & Security

All components of the barrier system of the site protection outlined in Section 2.5.14 will remain in place after quarry operations have ceased. In addition the extracted area will be fenced to prevent unauthorised access (refer to Figure 2.11).

The growth of vegetation on the bunds over the duration of the operation will have created a thick, virtually impenetrable hedgerow around the site. This, in conjunction with the other barriers, is considered sufficient to prevent access to the disused quarry workings (refer to Figure 2.11).

The area will be landscaped and vegetated so as to blend into the restored / existing landscape.

2.6.3 Long Term Stability of the Quarry

The final quarry face profiles have been designed by a geotechnical engineer to ensure long-term stability after completion of quarrying operations.

2.6.4 Long Term Surface Water & Groundwater Management

Surface water will be allowed to percolate directly into the underlying rock, resulting in diffuse input to the underlying groundwater table. A lake will be formed on site as groundwater returns to its natural level c.45mOD to 50mOD. It is anticipated that this will take between 15 and 20 years to occur, refer to Section 3.4 of the EIS for more details.

2.6.5 Decommissioning of Plant & Machinery

Redundant plant equipment and stockpiles will be removed from site on cessation of quarry activity. Machinery will either be utilised by Roadstone Provinces Ltd. on other sites, or be sold as working machinery or scrap.

2.6.6 Aftercare & Monitoring

It is proposed to carryout a final site inspection 6 months after formal site closure to ensure the final site restoration as implemented is functioning.

2.6.7 Restoration Bond

The applicant is prepared to submit a restoration bond or alternative financial surety to Kilkenny County Council as financial security for future restoration work.

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2.7 PROPOSED MITIGATION SUMMARY TABLE (Section 2)

Area of Operation	Proposed Design or Operational Element	Resulting Impact Mitigation	Cross Reference
Working Scheme Design	Topsoil/Overburden material will be stripped and utilised to construct screening berms	These berms are intended primarily for security and safety and are constructed to 5m in height.	2.5.5
	Initial quarry development will take place within the existing permitted area (P. Ref. 1/1/1234) and will progress in a southerly direction into the proposed extension area.	Development of the quarry in this manner has the advantage of enabling the operator to progressively restore the upper quarry face in a progressive manner as the quarry is pushed south. Development of the benches is effectively below ground and therefore not open to view from outside the lands. A southerly direction of working minimises the impact of the working area on the proposed N9/N10 Dual Carriageway and local residences to the south.	2.5.2
Screening Embankments / Overburden Storage Mounds	Prioritise construction of screening embankments.	To ensure rapid establishment of screening of overburden stripping / rock extraction operations. To aid noise attenuation of subsequent earthwork operations and future extraction operations	2.5.2 2.5.5
	Planting of screening embankments as soon as topsoil is placed.	To reduce any visual impact of screening embankments. To reduce the effects of erosion from wind and rain on topsoil.	2.5.5
	Topsoil to be stored separately until utilised for restoration purposes.	To ensure full utilisation of resource (i.e. topsoil not buried under overburden storage mounds). To ensure integrity of topsoil material maintained.	2.5.5
	Overburden Storage	To be stored in existing quarry void and utilised in future restoration works	2.5.5
Security	Provision of Barrier System, berm, impenetrable hedge and planting of barrier species	To secure site, protect the public and prevent unauthorised access to working quarry and meet the requirements of the Mines & Quarries Act. The growth of vegetation on the embankments over the duration of the operation will have created a thick, virtually impenetrable hedgerow around the site. This, in conjunction with the other barriers, is considered sufficient to prevent accidental access to the quarry workings on completion of workings.	2.5.14 2.6.2
	Lockable steel gate at entrance.	To prevent unauthorised vehicular entrance.	2.5.10
Transport	Site Access.	Direct access onto the Local County Road using the existing site entrance. Improved visibility splays at the site entrance by regular trimming of the vegetation and relocation of the boundary security fence where necessary. The existing entrance already provides a dust free surface from the entrance to the weighbridge / wheelwash to prevent carryout of material onto the public road.	2.5.10
	Provision of wheelwash and weighbridge.	The existing wheelwash is located close to the existing weighbridge, thereby ensuring that all trucks leaving the site exit through the wheelwash. The provision of a weighbridge ensures that no trucks leaving the site are overloaded.	2.5.10

Operational Methods	The operator will ensure that the drilling contractor uses a drill rig that is properly maintained and is fitted with adequate noise suppression and dust control / extraction equipment	To reduce any impact arising from drilling operations.	2.5.18
	Optimum blast design	The objectives of blasting practice adopted are to:- 1. ensure safety of all persons and property; 2. minimise the vibration and air overpressure; 3. allow prediction of vibration levels at given locations; 4. efficiently extract rock from the quarry face; 5. minimise the amount of explosives used.	2.5.3

Area of Operation	Proposed Design or Operational Element	Resulting Impact Mitigation	Cross Reference
Operational Methods (contd.)	Use of mobile in-pit crushing and screening plant.	A significant advantage of using mobile crushing and screening equipment is that the plant can be located close to the working face thereby reducing the impact of the plant with respect to dust, noise and visual intrusion.	2.5.4
	Screening berms constructed at a face slope of 1:1.5.	To ensure the face is geotechnically stable.	2.5.1
		To allow vegetation to become easily established.	2.5.2
		To prevent excessive erosion during construction.	2.5.6
	Water collecting in the quarry will be used to suppress dust on haul roads and quarry floors through the use of a water tanker with spray bars.	To minimise the generation of airborne dust from quarry workings and associated plant and machinery.	2.5.17
	All machinery to be regularly serviced and maintained.	To minimise generation of noise due to badly maintained machinery.	2.5.18
	All machinery to be CE Certified for compliance with EU noise control limits	To reduce noise levels.	2.5.18
Quarry access ramps to be maintained at a grade of 1:10 or less.	In order to minimise fuel consumption, wear and tear and noise generation associated with any heavy vehicles utilising this access.	2.5.18	
Quarry operator to review the current environmental management system (EMS).	To provide on-going feedback on the effectiveness of the proposed mitigation measures and provide data for planning and design of modifications or improvements.	2.5.19	

Water Management	Diesel fuel / lubricating oils / additives currently stored in suitably certified storage tanks. Waste oils are collected and recycled off site by an approved contractor. Refuelling of mobile plant takes place using a double skinned mobile fuel bowser.	To minimise risks of spillage and subsequent potential contamination of surface and ground waters.	2.5.7
	All quarry waters to be discharge via a Water Management System	To ensure water discharged off site is within accepted thresholds and meets the requirements of the existing IPPC Licence at the site.	2.5.8
Restoration	The proposed quarry will be worked in a phased manner.	A phased restoration plan will be implemented to minimise the extent and duration of the final restoration works. Progressive restoration allows vegetation to become established during the course of the development, thereby reducing the overall impact of the development (i.e. visual impact, dust impact, flora and fauna impact etc.). It also has the added benefit to the operator of spreading out the cost of restoration over the life of the development.	2.5.16 2.6
	Grading and planting on completed sections of the upper quarry face with suitable species of shrubs and climbers to create a vegetated ledge	Vegetation and natural colonisation on the upper bench will encourage growth on the faces. This will occur in a progressive manner as quarrying advances.	2.5.16 2.6
	Redundant plant equipment and stockpiles to be removed from site upon cessation of the operation.	To prevent any potential contamination of the site after cessation of operations.	2.5.16 2.6
	Submission of a restoration bond.	To provide financial security for the proposed final restoration works.	2.6

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REFERENCES

1. ***Ireland National Development Plan, 2000 – 2006 & 2007 - 2013***
2. ***Regional Planning Guidelines – South East Region – 2004***
3. ***National Spatial Strategy 2002 - 2020***
4. ***Kilkenny County Development Plan 2002 – 2007***
5. ***Draft Kilkenny County Development Plan 2008 - 2013***
6. ***Integrated Pollution Control Licensing – Guidance Notes for Noise in Relation to Scheduled Activities***, (1995), Environmental Protection Agency (EPA).
7. ***Quarries and Ancillary Activities – Guidelines for Planning Authorities***, (2004), Dept. of the Environment, Heritage and Local Government (DoEHLG)
8. ***Environmental Management Guidelines – Environmental Management in the Extractive industry (Non-Scheduled Minerals)***, (2006) – Environmental Protection Agency

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SECTION 2 – FIGURES

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SECTION 2 – APPENDICES

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APPENDIX 2.1

Landscape Plan / Overall restoration Scheme

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A.1 LANDSCAPE PLAN / OVERALL RESTORATION SCHEME

The overall restoration objective for the proposed opencast extension development at Dunbell Big is restoration to Wildlife Amenity after use (Refer to Section 2.5.16 and Section 2.6 and Figures 2.8, 2.9 & 2.10). Groundwater will be allowed to return to its natural level of between 45mOD and 50mOD.

1.1 Restored Levels

The final restored levels are indicated on Figure 2.8 and Figure 2.9.

1.2 Restoration Materials

The materials to be used in restoration will be sourced from overburden and topsoil stored on site. There will be 35,000 m³ of overburden and 10,000 m³ of topsoil required to construct the landscaped screening berms around the site – refer to Figure 2.7. It is estimated that approximately 20,000 m³ of topsoil and 70,000 m³ of overburden will be required for restoration works within the extracted area which consists of the upper quarry bench (Bench 1). Any materials not required for restoration works will be stored in the existing quarry void for restoration of this area.

1.3 Landscaping & Softworks Specifications

A tree planting schedule and softworks specification for the restoration works / landscaping is provided in Section 2.4.

A.2 Maintenance.

The maintenance period shall be 12 months from the date of practical completion agreed between the contractor and the client. The contractor shall make 2 visits to the site during this period to maintain the site to the specified standard and:-

- (i) Notify the client if he believes water would be beneficial during this period.
- (ii) Remove and replace immediately dead or diseased plants.
- (iii) Remove any dead wood from trees or plants.
- (iv) Re-firm loose trees, shrubs and plants as necessary.
- (v) Check stakes and re-affirm ties as necessary.
- (vi) Check spiral tree protection and replace where necessary.
- (vii) Prune shrubs, bushes etc. removing excessively strong/weak growth to promote healthy, even and well-balanced plants.

A.2.1 Restoration Scheme.

It is proposed to return the site to wildlife amenity after-use using topsoil and overburden materials. Groundwater will be allowed to return to its natural level of between 45mOD and 50mOD. Restoration will take place in a phased and progressive manner over the life of the quarry operations.

A.2.2 Cultivation.

- (i) Screening berms and overburden mounds are to be grassed and planted following construction.
- (ii) Prior to sowing of seed the upper 50mm is to be reduced to a fine till and fertiliser evenly distributed and raked in.

A.2.3 Seeding.

The seed to be used on the landscaped screening berms is to be fresh and for use in the season of seeding. A certificate is to be provided in respect of each consignment of seed mix giving the supplier's name, proportions of constituents of the mixture and a signature of representative of the supplier. Typical seed to be used shall of the following constituents (120 kg. per Ha.),

Perennial Ryegrass	12.5kg	25%
Strong Creeping Red Fescue	10.0kg	20%
Hard Fescue	15.0kg	30%
Smooth – Stalked Meadow Grass	5.0kg	10%
Highland Browntop Bent	5.0kg	10%
Huia White Clover	2.5kg	5%
Mixtures as per	50kg.	

The contractor shall mix seed well with bulking agent, e.g. dry sand, in order to assist an even distribution. Mix well before application and frequently during application. Divide the seed into two equal sowings in two transverse directions at the specified rates. After seeding lightly harrow or rake surface and roll lightly.

When grass is between 40mm and 75mm high the contractor shall remove debris and all stones and clay balls larger than 40mm in any dimensions and roll the area with a light roller. The area shall be cut with a rotscyth to approximately 35mm high.

Fertiliser applied shall consist of 10% nitrogen, 15% phosphoric acid and 10% potash. Spot treatment using a selective herbicide shall be applied to pernicious agricultural weeds such as thistle, docks and ragwort.

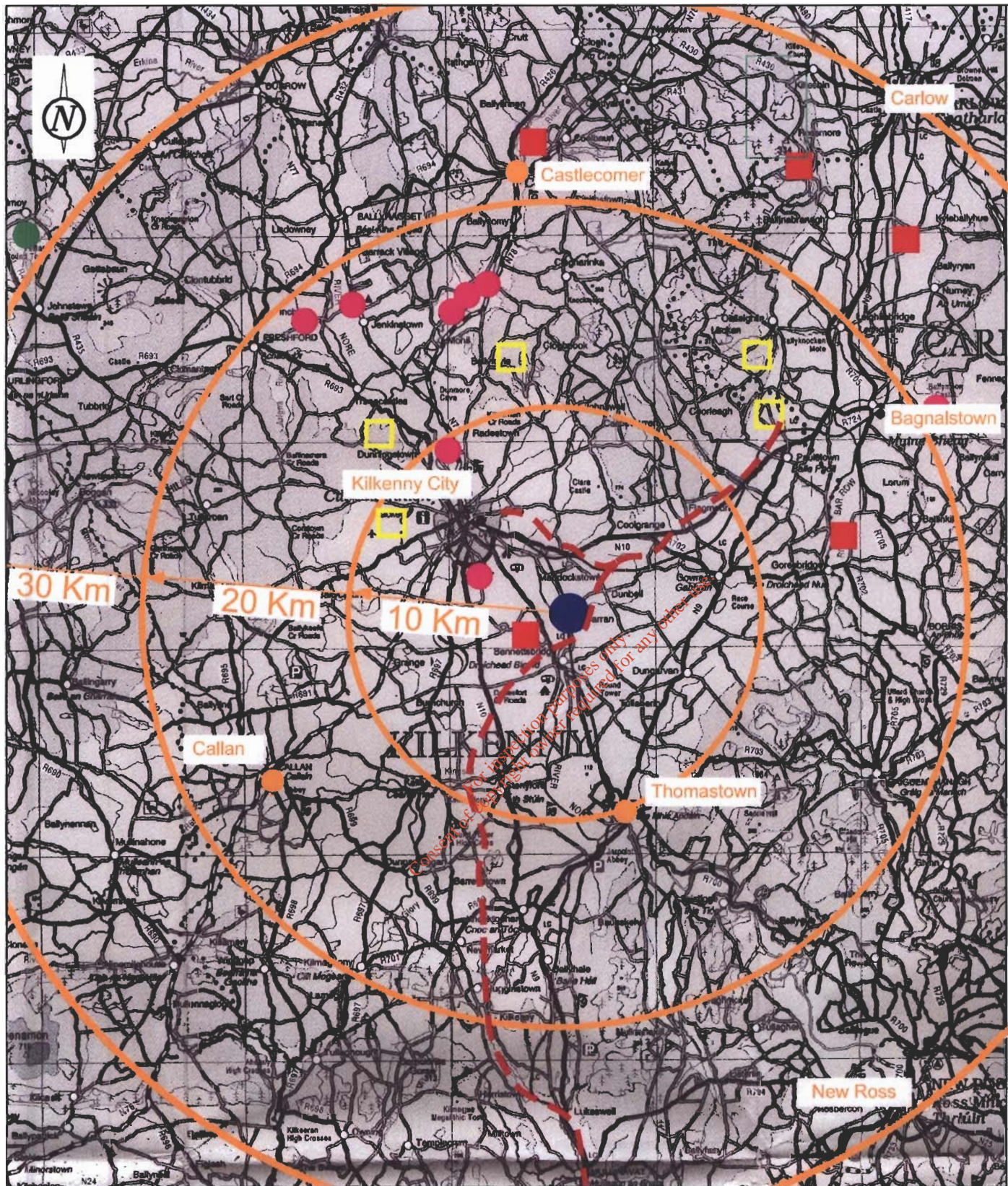
A.2.4 Trees/ Hedgerows.

A mixture of native tree species and shrubs are to be planted. Tree/ Shrub species to be planted are;

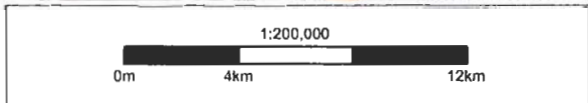
Table A2 1.1 Tree Planting Scheme

Area of Site (Ha)	Detail of Restoration	Tree Planting	No. of Trees Plant	Years
3.4	Screening Berms	Hawthorn (<i>Crataegus monogyna</i>) Blackthorn (<i>Prunus spinosa</i>) Hazel (<i>Corylus Avellana</i>)	2,250 2,250 500	Progressively (as berms constructed)
Quarry Face c.1850m	1 st Bench @ 50mOD	Ash (<i>Fraxinus excelsior</i>) Hazel (<i>Corylus Avellana</i>)	400 200	Progressively

- (i) Trees shall conform to BS 3936 for nursery stock and shall be supplied true to size and species name. Planting to take place between the months of October and May.
- (ii) All trees to be planted upright to the same depth as grown in the nursery. Fork base of tree pit to a depth of 150mm and remove stones over 75mm in dimension before positioning tree stake. The roots shall be spread evenly around the bottom of the pit and finely broken down topsoil returned and carefully worked between the roots and firmly consolidated. Trees, whips and shrubs to be protected by spiral tree guards or equivalent after planting.
- (iii) All light standard and bareroot trees are to have to have low single stakes driven into the pit before the tree is placed in the hole and backfilling commences.
- (iv) The tree stakes will be pressure impregnated peeled soft wood round stakes. Preservative shall be non-injurious to plant material. Stakes will be pointed at one end and free from protrusions. The tree stakes will be 1200mm, two thirds of their length to be driven into the ground.
- (v) Between the tree and the stake a rubber tree collar tree tie shall be entered, linked by a rubber strap running through the collar and around the tree, the collar will be fixed to the stake with two galvanised nails.
- (vi) Bareroot whips to be planted upright to their natural level. The pit holes shall be larger than the extent of the root system. Roots shall be spread out. Topsoil mixed with additives is to be placed around root, gently shaking them to and fro to avoid air pockets and trodden down firmly and filled in with topsoil.
- (vii) Container grown whips shall not be disturbed other than by taking them out of the pots to untwine and spread the roots out. Containerised plants shall be sufficiently moist to ensure that the plant can be easily removed without disturbing the roots. Soil shall be packed around the root-ball and firmly trodden down.



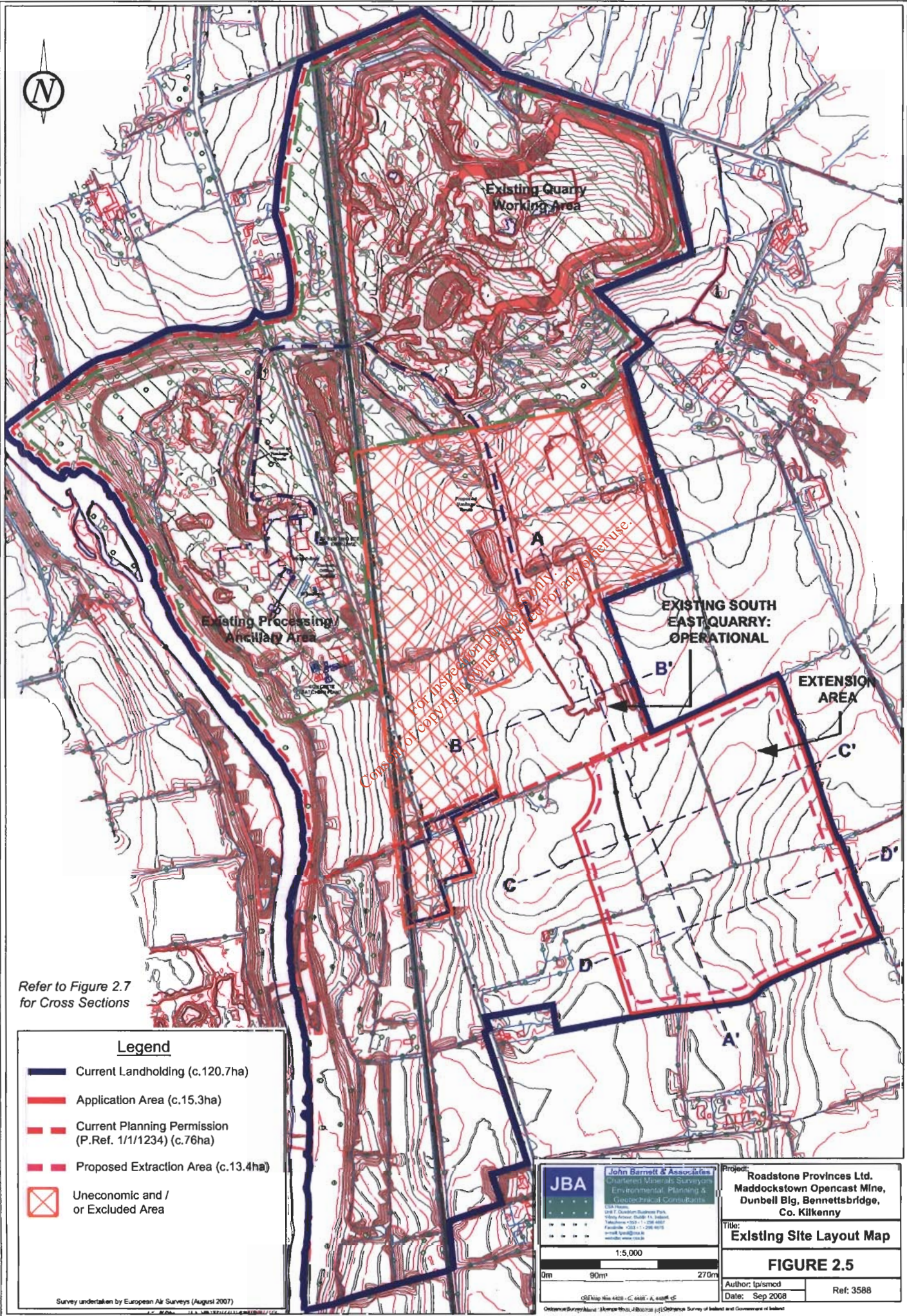
Information taken from "Directory of Active Pits & Quarries 2001" - GSI
 Extract from 1:250,000 O.S.I. Map East



- Site Location
- Other Quarry / Pit Locations**
- Aggregate Quarry
- Sand & Gravel Pits
- Dimension Stone Quarries
- Underground Mine
- N9/N10 Dual Carriageway (Under Construction)

	ROADSTONE PROVINCES LTD Maddoxstown Opencast Mine, Dunbell, Bennettsbridge, Co. Kilkenny	
	REGIONAL ECONOMIC MAP	
Author: smcd/tp Date: Sep 2008	FIGURE 2.4	
John Barnett & Associates Ltd, 7 Dundrum Business Park, Windy Arbour, Dublin 14		

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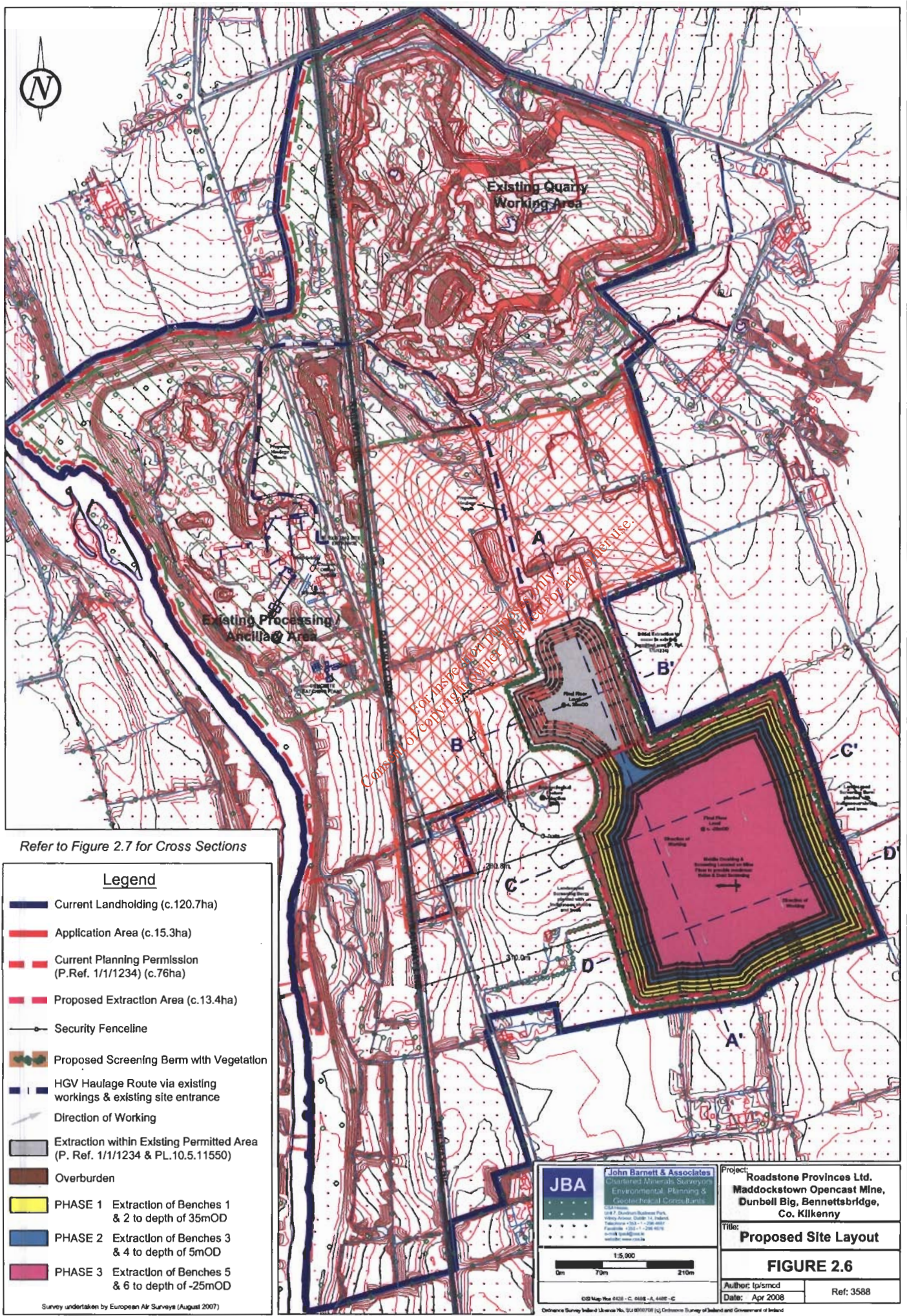
Refer to Figure 2.7 for Cross Sections

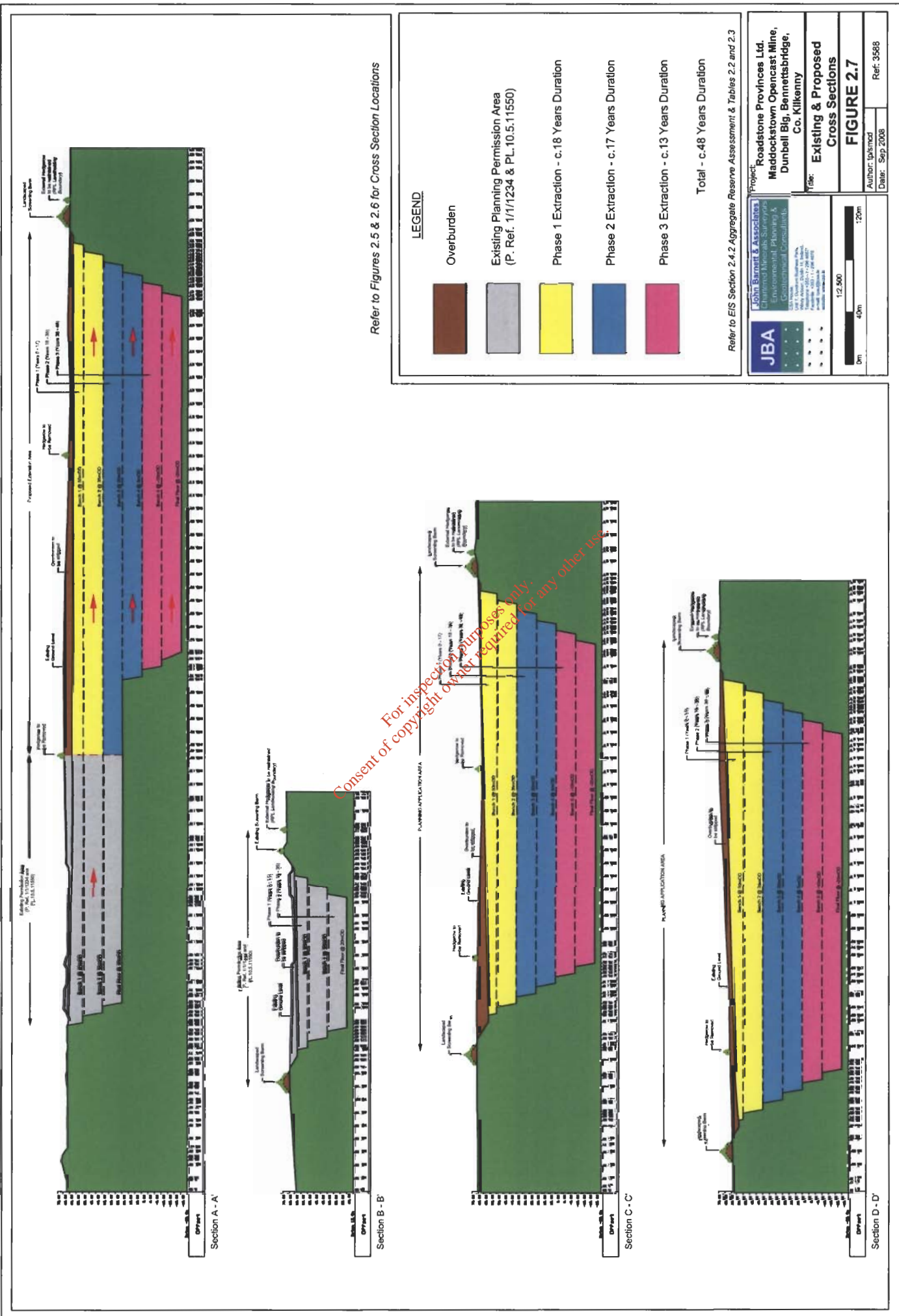
Legend	
	Current Landholding (c.120.7ha)
	Application Area (c.15.3ha)
	Current Planning Permission (P.Ref. 11/11234) (c.76ha)
	Proposed Extraction Area (c.13.4ha)
	Uneconomic and / or Excluded Area

Survey undertaken by European Air Surveys (August 2007)

	John Barnett & Associates Chartered Minerals Surveyors Environmental Planning & Geotechnical Consultants
	<small> Unit 7, Dunlavin Business Park, White Horse, Dunlavin, Co. Wick Telephone: +353 (0) 53 938 4887 Facsimile: +353 (0) 53 938 4875 Email: jba@jba.ie Website: www.jba.ie </small>
1:5,000 	
<small>© 2008 JBA 4208 - C. 4488 - A. 4498 ©</small> <small>Orthorelief/Topographic Map: 1:50,000, 1:25,000, 1:10,000 (© Ordnance Survey of Ireland and Government of Ireland)</small>	

Project: Roadstone Provinces Ltd. Maddockstown Opencast Mine, Dunbell Bg, Bennettsbridge, Co. Kilkenny	
Title: Existing Site Layout Map	
FIGURE 2.5	
Author: tp/smcd Date: Sep 2008	Ref: 3588





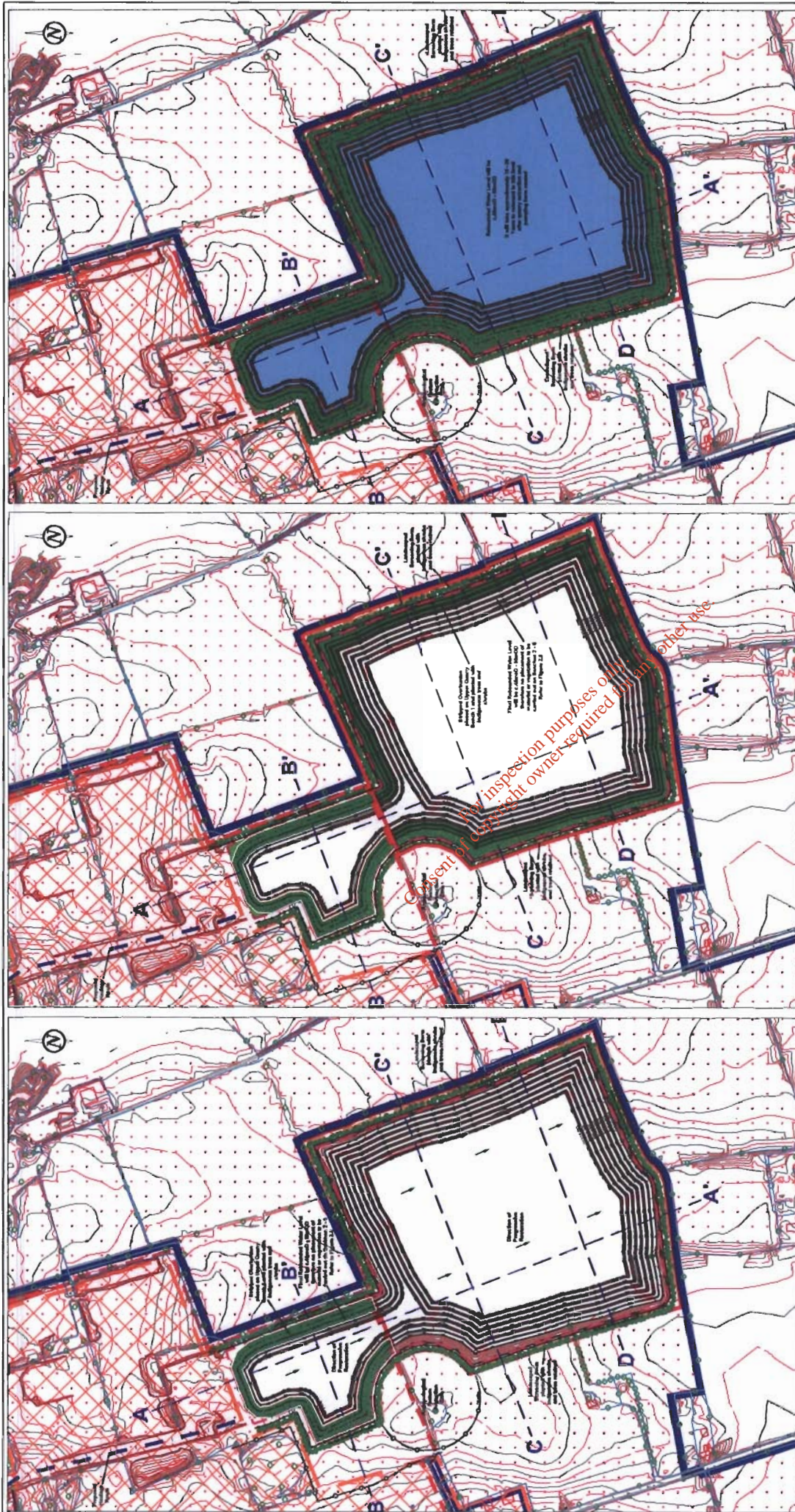


Figure 2.8 (A)
PHASE 1 (Years 3 - 10) Restoration of Bench 1 within Existing Permitted Area

Figure 2.8 (B)
PHASE 2 (Years 5 - 15) Restoration of Bench 1 within Proposed Extension Area

Figure 2.8 (C)
PHASE 3 (Years 34 - 36) Water Level in Quarry Void allowed to Rebound to Natural Level.

NOTE: Years 16 - 33 No Restoration Works Required until Full Extraction of Banches 3 - 6 has been carried out.

Legend

- Current Landholding (c.120.7ha)
- Application Area (c.15.3ha)
- Current Planning Permission (P.Ref. 1/1/1234) (c.76ha)
- Screening Berm with Vegetation constructed during Operational Phase of Development (Refer to Figure 2.10)
- Water Body
- Phased Restoration of Upper Bench (Refer to Figure 2.10)
- Direction of Restoration
- Security Fenceline

Refer to Figure 2.9 for Cross Sections

JBA
JOHN BURTON & ASSOCIATES
Surveyors
Environmental Planning &
Geotechnical Consultants

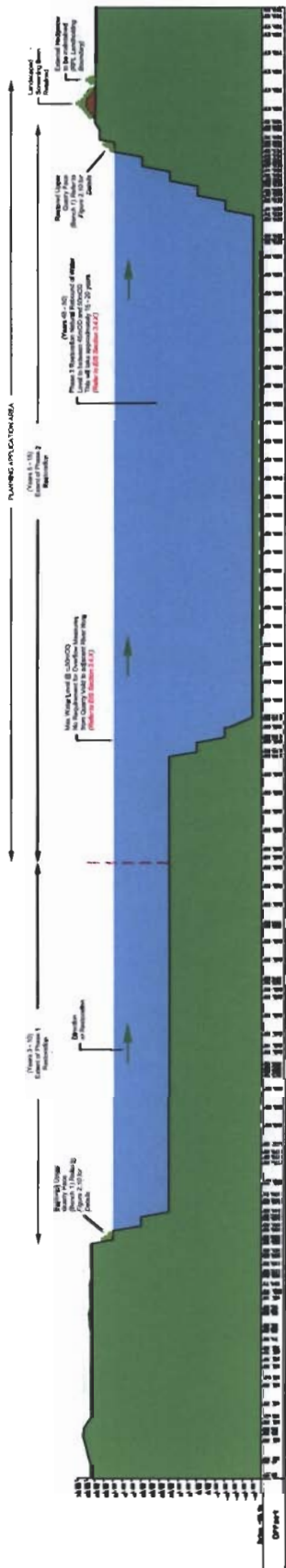
Project: Roadstone Provinces Ltd.
Maddockstown Opencast Mine,
Dunbell Big, Bennettsbridge,
Co. Kilkenny

Title: Restoration Scheme

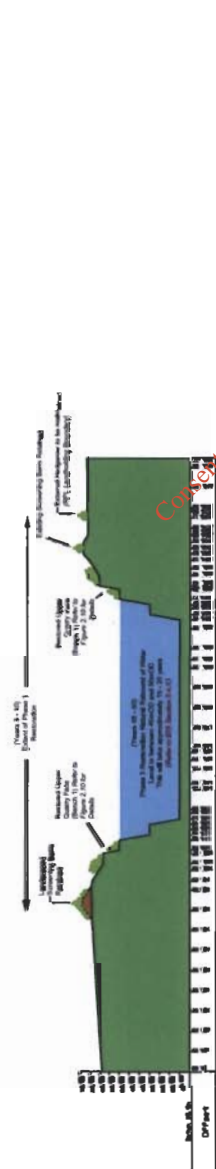
Author: Updated
Date: Sep 2008
Ref: 3588

Scale: 1:5,000
20m
10m
5m

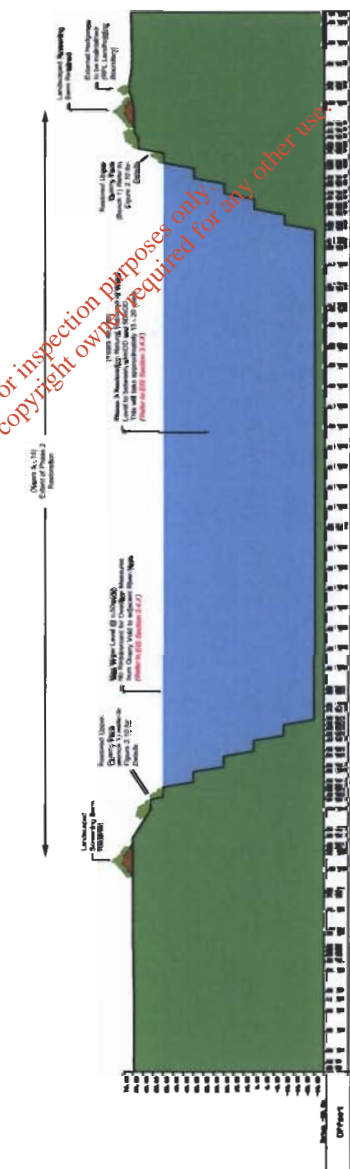
Survey undertaken by European A.I. Surveyors (Aug 2007)
Chris Longley, E. Lee, A. Lyle, C.
OS Licence No. 1000798 (© Ordnance Survey of Ireland and Government of Ireland)



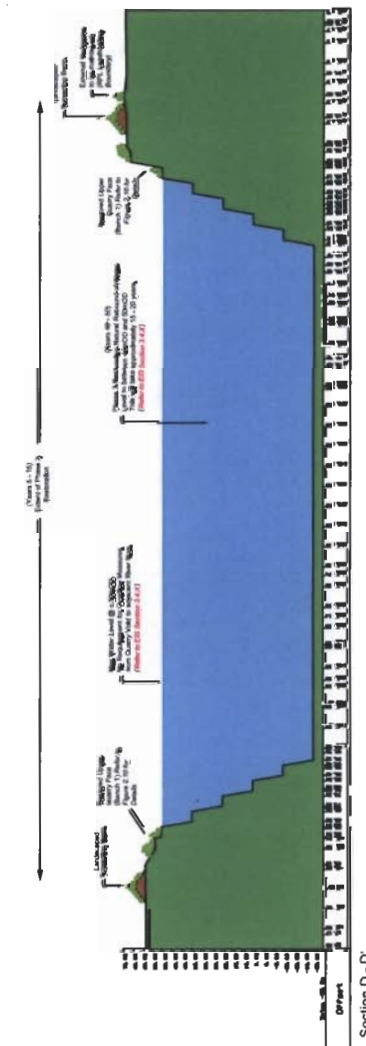
Section A - A'



Section B - B'



Section C - C'



Section D - D'

Refer to Figure 2.8 for Cross Section Locations
 Refer to Figure 2.10 for Restoration Upper Face
 & Screening Berm Detail
 Refer to EIS Section 3.4. Surface Water & Groundwater

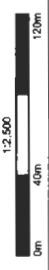
JBA
 John Barnett & Associates
 Chartered Accountants, Surveyors
 Environmental, Planning &
 Geotechnical Consultants

Project:
 Roadstone Provinces Ltd.
 Maddockstown Open-cast Mine,
 Dumbell Big, Bennettsbridge,
 Co. Kilkenny

Title:
 Restoration Cross Sections

FIGURE 2.9












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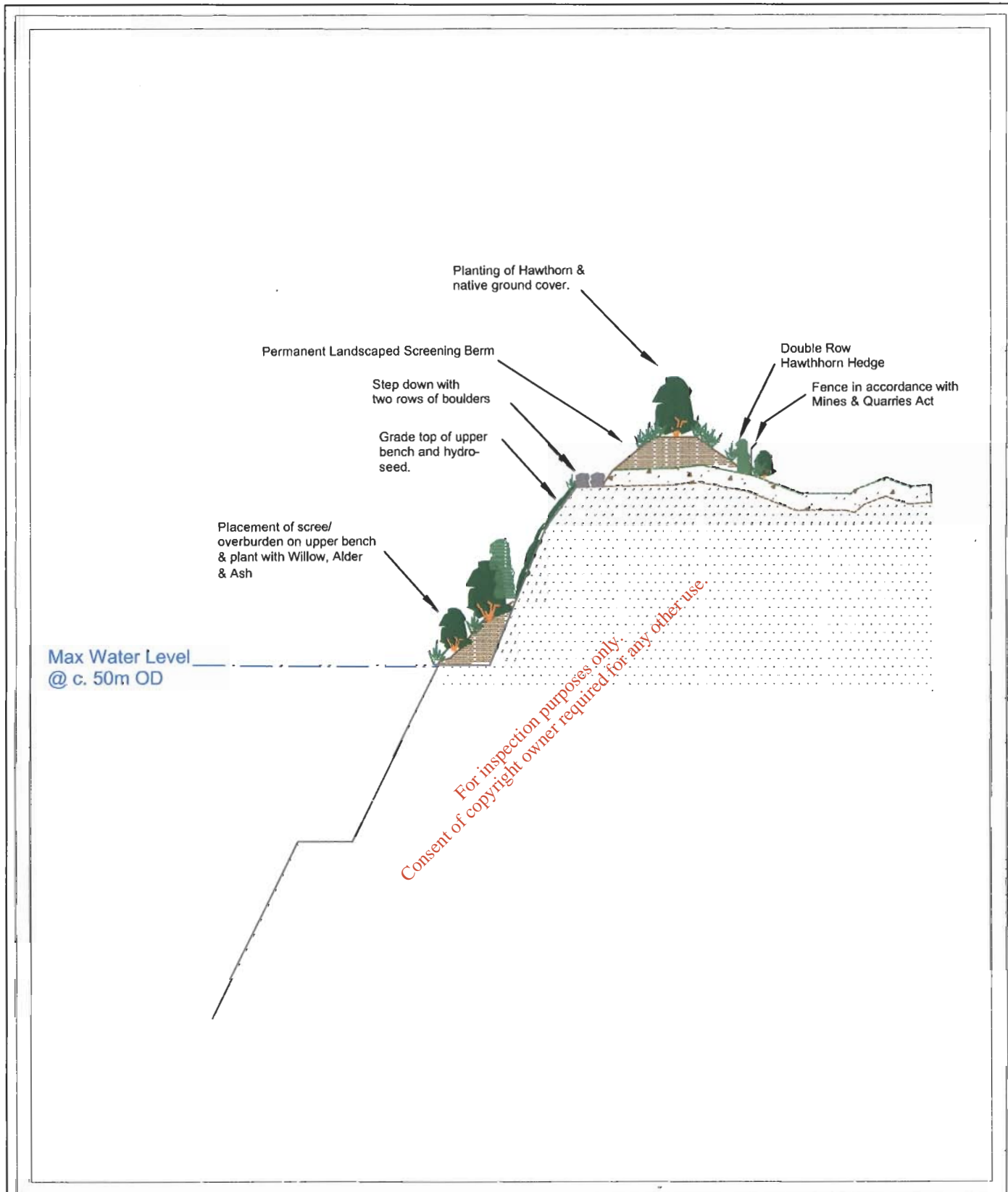
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Legend


-  Current Landholding (c.120.7ha)
-  Screening Berm with Vegetation constructed during Operational Phase of Development (Refer to Figure 2.10)
-  Water Body (Naturally forming after rock extraction has ceased)
-  Phased Restoration of Upper Bench (Refer to Figure 2.11)
-  Security Fenceline
-  Existing Agricultural Lands Retained
-  Natural Colonisation of Bare Ground
-  Areas to be Restored to Agricultural After-use
-  Existing Trees / Woodlands Retained
-  Proposed Tree Planting / Woodlands
-  Existing Scrub / Woodland Areas Retained and Planted with Additional Native Species

 JBA John Barnett & Associates Chartered Minerals Surveyors Environmental Planning & Geotechnical Consultants Unit 7, Clonsilla Business Park, Wexford, Co. Wick, Ireland Telephone: +353 (0) 53 932 4527 Fax: +353 (0) 53 932 4528 Email: john@jba.ie www.jba.ie	Project: Roadstone Provinces Ltd. Madockstown Opencast Mine, Dunbell Bg, Bennettsbridge, Co. Kilkenny
	Title: Overall Closure Scheme FIGURE 10
Survey undertaken by European Air Surveys (Aug 2007) OS Map No: 4428 © 1998 - A, 1998 - C Ordnance Survey Ireland Licence No. 101/2006/128 (a) Ordnance Survey of Ireland and Government of Ireland	Author: lp/smd Date: Sep 2008 Ref: 3588



No Scale

Legend

	ROADSTONE PROVINCES LTD Maddockstown Opencast Mine, Dunbell Big, Bennettsbridge, Co. Kilkenny Typical Section of Restored Upper Quarry Face (Bench 1) & Permanent Landscaped Screening Berm	
	Author: smcd/tp Date: Apr 2008	FIGURE 2.11
John Barnett & Associates Ltd, 7 Dundrum Business Park, Windy Arbour, Dublin 14		

SECTION 3.1 – Human Beings

CONTENTS

3.1.1 DEMOGRAPHY

3.1.2 EMPLOYMENT

3.1.3 AMENITY

3.1.4 SOCIAL INFRASTRUCTURE

i. Residential Dwellings

ii. Education

iii. Health

iv. Security

v. Community Facilities

vi. Local Water Supply and Services

vii. Transportation

3.1.5 POTENTIAL IMPACTS

3.1.6 MITIGATION MEASURES

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REFERENCES

FIGURES

Figure 3.1.1 Location of Dwellings

3.1.1 DEMOGRAPHY

Maddockstown Quarry is located in the townland of Dunbell, approximately 2.5km north of Bennettsbridge and 6.5km southeast of Kilkenny town. From 2002 to 2006 the population of County Kilkenny increased by 9%. From a more local perspective, over the same period of time, Gowran's population increased by 7.3% and Paulstown significantly increased by 104.8%, while Bennettsbridge's population decreased by 6.8%. These statistics are in contrast to the national increase in population of just 8.2% from 2002 - 2006. Table 3.1 (a) illustrates the population statistics of the towns surrounding the existing quarry, while 3.1 (b) demonstrates Kilkenny's population statistics compared with the rest of the country.

Table 3.1 (a): Population Change 2002-2006 at Town Level

Population	Persons 2002	Persons 2006	Actual Change 2002-2006	% Change 2002-2006
Bennettsbridge	735	685	-50	-6.8%
Paulstown	292	598	306	104.8%
Gowran	454	487	33	7.3%
Kilkenny Environs	12,144	13,518	1,374	11.3%

Table 3.1 (b): Population Change 2002-2006 at County, Provincial & National Level

Population	Persons 2002	Persons 2006	Actual change 2002-2006	% change 2002-2006
County Kilkenny	80,339	87,558	7,219	9.00%
Leinster	2,105,579	2,295,123	189,544	9%
Ireland	3,917,203	4,239,848	322,645	8.20%

Kilkenny has experienced considerable economic growth in both financial services and the healthcare sector, resulting in increased employment and population growth. Expansion of Waterford city has also led to an overspill of the environs of Waterford into County Kilkenny.

The Kilkenny Draft County Development Plan 2008-2014 envisages an increase in the county's population by a minimum of 19.9% to a maximum of 34.3% by 2020. The city and its environs are expected to increase by a minimum of 25.7% to a maximum of 36.5% over the same period. (Figures based projected population 'high' trends, 'central' trends from the DoEHLG and 'low' CSO scenarios, refer to Table 3.1 c)

Kilkenny currently has a higher average number of people per private household at 2.9 than the regional average of 2.80 and the national average of 2.80 (refer to Table 3.1 d). It is estimated that with the projected increase in population and the average number of people per private household, that County Kilkenny will require 7,102 – 8,908 new households, with Kilkenny city and its environs requiring 1,207 – 1,652 new households by 2014.

Table 3.1 (c): Summary of Population and Additional Households up to 2014

Population Scenario	Kilkenny Population 2014	County New Households	Kilkenny City Population 2014	and Environs New Households
High	103,639	8,908	26,602	1,652
Central	102,187	8,282	26,374	1,538
Low	98,745	7,102	25,435	1,207

These statistics have major implications for the physical and social planning of this county, for the delivery of public services and also for building a sense of identity and community among new and long-established residents. Provision of employment and resourcing of all public sector

infrastructures is a key requirement to enable integrated development to occur to cater for the range of requirements of the future population

Given that the area surrounding the proposed development

- (i) is located close to the existing N10 – refer to EIS Section 3.11
- (ii) is in relatively close proximity to expanding settlement of Kilkenny city
- (iii) the projected population increases in the County Development Plan

it is considered that there will be further increases in the population of the surrounding Kilkenny area and therefore an increase in the demand for aggregates in the catchment area.

3.1.2. EMPLOYMENT

The past decade has seen several changes to the economy of Kilkenny. Employment derived from agriculture dropped from 24% to 10.7% between 1986 – 2002, this is still significantly higher than the national average of 4.8%. Kilkenny's dominant industries are technology, tourism, craft & design, engineering and food processing.

55,788 of Kilkenny's inhabitants are deemed to be in the 'dependency ratio.' People within this category are considered ineligible for employment. This ratio encompasses people under the age of 15 and over 65. Their dependency ratio currently stands at 32.94% (refer to table 3.1 c), but does not include people who may be studying full time or unable to work due to illness.

Table 3.1 (c): Population in county Kilkenny classified by age group (CSO, 2006)

Total	0-4 yrs	5-9 yrs	10-14 yrs	15-19 yrs	20-24 yrs	25-29 yrs
87558	6340	6268	6245	6353	5595	6698

30-34 yrs	35-39 yrs	40-44 yrs	45-49 yrs	50-54 yrs	55-59 yrs	60-64 yrs
6751	6588	6437	6081	5388	4815	4007

65-69 yrs	70-74 yrs	75-79 yrs	80-84 yrs	85+ yrs
2942	2547	2005	1413	1085

In a bid to attract further investment to the county's employment sector, the Kilkenny County Development Plan 2002 states that the planning authority will support economic development by:

- Identifying areas offering opportunities for job creation
- Provision of an adequate road system within the county
- Provision of sanitary services and other infrastructure
- Zoning of sufficient land for industrial and commercial industry
- Sustainable management of natural resources e.g. land, water and minerals which contribute to the provision of jobs

- Dealing efficiently with development proposals through the planning control system

The Kilkenny Draft County Development Plan 2008-2014 recognises the importance of the extractive industry in relation to employment and economic development.

'The council recognizes the importance of the extractive industries to the local and national economy as valuable sources of raw material for industry in general and the construction industry in particular and as an important source of employment. The products are the essential buildings materials for the provision of housing and infrastructural projects. The industry is therefore essential to the continued development of the county and the achievement of the objectives in the National Development Plan.'

3.1.3. AMENITY

The development is not included in any area of scientific interest, nor has any special amenity order (e.g. Natural Heritage Area, Special Area of Conservation) been made in relation to the site, see Sections 3.2 & 3.4 for further information. The stream valley at the NW corner of the site and some of the adjacent grassland is included in the River Barrow and River Nore candidate SAC (Code No 2162). This does not extend to the proposed extension quarry area in the SE which has little if any connection with the main valley.

3.1.4. SOCIAL INFRASTRUCTURE

i Residential Dwellings

There are no residential dwellings within 150m of the proposed extension area. Approximately 6 dwellings are located 150 – 250m from the extension area. The nearest dwelling to the existing quarry is located approximately 150m from the existing extraction area. Figure 3.1.1 shows the location of dwellings in the vicinity of the development.

ii Education

The population of the surrounding area is serviced by several schools in Bennettsbridge, Gowran, Thomastown and Kilkenny city they are as follows;

Primary Schools

Bennettsbridge

- Bennettsbridge Mixed National School

Gowran

- Scoil Náisiúnta Mhuire

Thomastown

- Convent Primary National School
- Lady Well Boys National School
- Scoil Náisiúnta Tobair Mhuire

Kilkenny

Kilkenny has 15 primary schools

Secondary Schools

Thomastown

- Grennan College

Kilkenny

- Coláiste Pobail Osraí
- Kilkenny College
- Kilkenny Loreto Secondary School
- Christian Brothers Secondary School
- St Kieran's College

University

- NUI Maynooth – Kilkenny campus

iii. Health

Bennettsbridge is serviced by several hospitals in nearby towns, they are as follows:

- St. Canice's Hospital Kilkenny
- St. Luke's General Hospital
- Aut Even Hospital
- Kilcreene Orthopaedic Hospital, Kilkenny
- St. Canice's psychiatric Hospital Kilkenny

iv. Security

The nearest Garda station is located in Bennettsbridge, with fire stations located in Thomastown and Kilkenny town.

v. Community Facilities

Facilities in Bennettsbridge include Post Office, GAA club, a primary school, pubs and local shops.

vi. Local Water Supply and Service

The residences of Bennettsbridge just south of the development are serviced by a water scheme provided by Kilkenny County Council.

vii. Transportation

This development is accessed via an existing county road and north onto the N10 (Dublin to Kilkenny) a national primary road or south towards Bennettsbridge. Although Maddockstown is not serviced by an operating train station, it is in close proximity to several of them, the nearest being Kilkenny city. The National Rail Network provides the county with direct links to both Dublin and the rest of the country. The draft county development plan 2008-2012 states that the *Regional Planning Guidelines* identified a need for the development of rail cargo depots at Belview and Maddockstown, as the service would offer huge potential to industry in the region.

Bus Eireann and a number of private operators service the county of Kilkenny. In 2006 the pilot 'Ring a Link Rural Transport Initiative' was made permanent. This scheme runs in Carlow, Kilkenny and South Tipperary. The 'demand response transport' system is based on the concept of the operator offering flexible routes and services suitable to the area and the prospective customer. Taxis and hackneys also form an important part of the transport infrastructure.

3.1.5 POTENTIAL IMPACTS

The development, as with all similar developments of this nature, is brought about by the continued demand of society to have a secure supply of construction materials and provide housing, education facilities, health facilities and public infrastructure (roads, water supply, wastewater treatment and rail facilities)

The development will have a positive impact in that it will provide long term sustainable employment, including direct employees, sub-contractors, hauliers and services, and in addition personnel will contribute indirectly to sustaining and developing the local and regional economy through continued supply of construction material products.

Potential negative impacts on human beings and residential amenity of the area arising from the proposed development relate mainly to water, dust, noise & vibration, visual issues, and traffic.

3.1.6. MITIGATION MEASURES

The following sections of this EIS provides an assessment of the potential impacts referred to above, and describes existing and /or proposed mitigation measures to ensure that such impacts are eliminated and/or minimised.

- Water – Section 3.4
- Air Quality – Section 3.6
- Noise & Vibration – Section 3.7
- Landscape – Section 3.8
- Traffic – Section 3.11

With the continued implementation of these mitigation measures, it is considered that the proposed extension to the existing quarry will not result in any significant impact on the residential amenity of the area.

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Kilkenny Draft County Development Plan 2008-2014

Kilkenny County Development Plan 2002

Census 1996, 2002 and 2006.

www.kilkennycoco.ie

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SECTION 3.1 – FIGURES

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LEGEND	
	Land Holding (c.120.7ha)
	Current Planning Permission PL 10.5.11550 (c.75.9ha)
	Application Area (c.15.3ha)
	Extraction Area (c.13.4ha)
	250m / 500m Application Boundary Offset
	M10 Motorway Under Construction
	Residence Locations

	John Barnett & Associates Chartered Minerals Surveyors Environmental Planning & Geotechnical Consultants
	<small> Unit 1, Dunham Business Park, Dunham Village, Rostow, VA, Ireland Telephone +353 1 298 4837 Facsimile +353 1 298 4838 e-mail john@jba.ie website www.jba.ie </small>
Scale: 1:7,500 	
<small>Aerial Photograph supplied by European Air Surveys (August 2007)</small>	

Project: Roadstone Provinces Ltd. Maddockstown Quarry, Dunbell, Bennettsbridge, Co. Kilkenny	
Title: Residence Location Map	
FIGURE 3.1.1	
Author: tp/smod	Ref: 3588
Date: Sep 2008	

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SECTION 3.2. – FLORA & FAUNA

CONTENTS

- 3.2.1. INTRODUCTION**
 - 3.2.1.1 Outline Scope of Works**
 - 3.2.1.2 Project Team & Consultations**

- 3.2.2 BASELINE ENVIRONMENTAL STUDY**
 - 3.2.2.1 Outline of Site**
 - 3.2.2.2 Habitats & Vegetation**
 - 3.2.2.3 Fauna**
 - 3.2.2.4 Evaluation**

- 3.2.3 BASELINE ENVIRONMENTAL STUDY**
 - 3.2.3.1 Direct Impacts**
 - 3.2.3.2 Indirect Impacts**

- 3.2.4 MITIGATION MEASURES**

REFERENCES

SECTION 3.2 PLATES

SECTION 3.2 - FIGURES

Figure 3.2.1 Habitat Map

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3.2.1. INTRODUCTION

3.2.1.1 OUTLINE OF SCOPE OF WORKS

The proposed quarry extension area was given a walkover survey to record the major habitats with their constituent plants and vertebrate animals. The purpose was to describe the ecology of the area, to record any special features and to evaluate the inherent interest of the flora and fauna. The investigation follows the methodology of the Phase I Habitat Survey (JNCC 1991) but uses the habitats of the Heritage Council publication (Fossitt 2000).

3.2.1.2 PROJECT TEAM & CONSULTATIONS

The site was visited by Roger Goodwillie and Sinead McDonnell in September 2007 and also discussed with the local conservation officers of the National Parks & Wildlife Service. A copy of the Pre-Planning consultation document was provided to the DoEHLG National Parks & Wildlife Service.

3.2.2 BASELINE ENVIRONMENTAL STUDY

3.2.2.1 OUTLINE OF SITE

The existing site layout is shown on EIS Figures 1.3 and 1.4. The existing development includes the existing processing / ancillary area on the western side of the railway line; the existing quarry in the northeastern part of the site; and the existing south-east quarry. The existing quarry operations are located on the eastern side of the railway line. The River Nore flows in a southerly direction along the western boundary of the site.

The proposed quarry extension is located in an area of farmland on the south-eastern part of the site. The nearest point of the proposed extension area will be over 400 metres to the east of the River Nore, refer to Figure 3.2.1

3.2.2.2 HABITATS & VEGETATION

Much of the overall site area can be classified as active quarries and mines (ED4 in Fossitt 2000) whether it is the current extraction area at the northern end or the piles of product and finer sand that occur between it and the process area, and around the latter. Significant re-establishment of vegetation has occurred on the western side of the void to create recolonising bare ground (ED3) which also parallels the railway. South from the main quarry there is an area of scrub (WS1) and then a substantial store of overburden on former fields which supports little vegetation because of vehicular traffic. South again there is a new extraction area being stripped of soil with berms around the edges and then a larger area of tillage fields (arable crops BC1) separated by hedgerows (WL1) where the proposed application is being made.

Fields

The fields comprising the proposed extension area were used for wheat in 2007 and have little weed flora because of herbicide use. There are traces of wild oat *Avena fatua*, scutch

Elytrigia repens, rough-stalked meadowgrass *Poa trivialis* and annual meadowgrass *Poa annua* within the crops and marginally a greater variety-

<i>Veronica persica</i>	field speedwell
<i>V.arvensis</i>	wall speedwell
<i>Myosotis arvensis</i>	field forget-me-not
<i>Anisantha sterilis</i>	barren brome
<i>Geranium dissectum</i>	cut-leaved geranium
<i>Atriplex patula</i>	orache
<i>Aethusa cynapium</i>	fool's parsley
<i>Chenopodium album</i>	white goosefoot
<i>Polygonum aviculare</i>	knotgrass
<i>Fallopia convolvulus</i>	black bindweed

The fields are divided by hedges which consist of hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa* and elder *Sambucus nigra* with some ash *Fraxinus excelsior* and small quantities of sycamore *Acer pseudoplatanus*, common gorse *Ulex europaeus* and, in the SE corner, damson *Prunus domestica*. The trees are small except in an enclosed haggard which is off-site but included in the general area. Brambles *Rubus fruticosus*, ivy *Hedera helix*, wild rose *Rosa canina* and field rose *R.arvensis* are ubiquitous through the other woody species and there is also occasional honeysuckle *Lonicera periclymenum*.

At the base of the hedges there is generally a strip of uncultivated ground on which grassland and 'edge' species grow. False oat *Arrhenatherum elatius*, cocksfoot *Dactylis glomerata*, red fescue *Festuca rubra* and timothy *Phleum pratense* occur in different places and there is often

<i>Urtica dioica</i>	nettle
<i>Galium aparine</i>	goosegrass
<i>Heracleum sphondylium</i>	hogweed
<i>Anthriscus sylvestris</i>	cow parsley
<i>Lapsana communis</i>	nipplewort
<i>Stachys palustris</i>	marsh woundwort
<i>Senecio jacobaea</i>	ragwort
<i>Lathyrus pratensis</i>	meadow vetchling
<i>Brachypodium sylvaticum</i>	false brome
<i>Geum urbanum</i>	wood avens
<i>Sonchus arvensis</i>	field sow-thistle
<i>Trifolium pratense</i>	red clover
<i>Veronica chamaedrys</i>	germander speedwell
<i>Knautia arvensis</i>	field scabious

Near the road there is a field corner with greater knapweed *Centaurea scabiosa* and rest harrow *Ononis repens*, two species associated with thin limestone soils in Kilkenny.

Adjoining habitat

The rest of the quarry area consists of bare and broken rock with sandier fractions around the process area. At the northern end there are stockpiles of aggregates between the railway and the road but along the railway itself and at the western and northern sides of the current extraction area there has been significant recolonisation by plants including

<i>Hypericum perforatum</i>	perforate St John's wort
<i>Origanum vulgare</i>	marjoram
<i>Centaurium erythraea</i>	centaury
<i>Senecio jacobaea</i>	ragwort
<i>Erigeron acer</i>	blue fleabane
<i>Carlina vulgaris</i>	carline thistle
<i>Blackstonia perfoliata</i>	yellow wort
<i>Leucanthemum vulgare</i>	dog daisy
<i>Leontodon hispidus</i>	rough hawkbit
<i>Centranthus ruber</i>	wall valerian
<i>Daucus carota</i>	wild carrot
<i>Fragaria vesca</i>	wild strawberry
<i>Briza media</i>	quaking grass
<i>Sanguisorba minor</i>	salad burnet
<i>Pimpinella saxifraga</i>	burnet saxifrage
<i>Succisa pratensis</i>	devilsbit
<i>Anthyllis vulneraria</i>	kidney vetch

More generally the disturbed soils support typical quarry species such as the grasses *Festuca rubra*, *F.ovina*, *Holcus lanatus*, *Cynosurus cristatus* and glaucous sedge *Carex flacca* along with broad-leaved plants, e.g.

<i>Tussilago farfara</i>	coltsfoot
<i>Leontodon saxatilis</i>	small hawkbit
<i>Pilosella officinarum</i>	mouse-eared hawkweed
<i>Linum catharticum</i>	fairy flax
<i>Arenaria serpyllifolia</i>	sandwort
<i>Salix cinerea</i>	grey willow
<i>Ulex europaeus</i>	common gorse
<i>Potentilla reptans</i>	creeping cinquefoil
<i>Medicago lupulina</i>	black medick

There is a little orange mullein *Verbascum phlomoides*, columbine *Aquilegia vulgaris* and hispid fleabane *Conyza cf. blitaoana* – introduced species that are sometimes naturalised. Bushes and young trees are not uncommon and there is a stabilised bank on the western side of the main quarry with three willows *Salix caprea*, *S.cinerea* and *S.viminalis*

Low sites where seasonal water lies, support common osier *Salix viminalis*, redshank *Persicaria maculosa* and toad rush *Juncus bufonius* but there are few of these and no permanent water except for a stream which has been diverted along the railway side to discharge in the NW corner.

The landholding includes several areas of scrub: there is some planted to the west of the road at the entrance to the works and also along the stream on the northern boundary down to the river. More natural areas occur at the SE and SW edges of the present quarry, some in fields that will not be excavated. The natural ones are composed of gorse *Ulex europaeus*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus*. Openings between the bushes which are much grazed by rabbits support stunted red fescue *Festuca rubra* and glaucous sedge *Carex flacca*, self-heal *Prunella vulgaris*, hard rush *Juncus inflexus* and various mosses.

3.2.2.3 FAUNA

The rabbit is abundant with burrows in some of the marginal hedges and scrub areas. A hare was also seen and the animals probably take refuge in the scrub for resting and breeding. There was evidence of foxes but none of badgers although individuals of the latter species are likely to visit the cereal fields at times.

Smaller mammals are likely to include stoat, brown rat, field mouse and pygmy shrew. Bat habitat is poorly developed except along the trees lines on the northern and western boundaries. There is possible roosting and feeding habitat in the haggard enclosed by the southern end of the site.

The birds seen on the site visits were predominantly those of farmland. Among the larger species were pheasant, woodpigeon, rook, jackdaw and magpie. The first two are likely to nest on site though the others are more likely to be visitors. Smaller 'hedge' species include blackbird, song thrush, robin, wren, dunnock linnet, chaffinch and yellowhammer. In summer chiffchaff are likely to occur, at least in the adjacent haggard, while a few snipe would be expected to use the fields in winter. Ravens have nested in the quarry in some years but not peregrine, as far as is known.

A variety of butterflies would be expected in the general quarry area because of the diversity of habitats. As well as the three whites (large, small and green-veined) the small tortoiseshell, speckled wood, meadow brown, painted lady, red admiral, common blue, small copper and wall, all occur elsewhere in Maddockstown. The site visit was too late to investigate this group but there is no species that would be dependant on the extension area. A record of a rare bee *Andrena fulva* was made from the railway 'SE of Maddockstown' in 1925 by A.W Stelfox. The species has not been seen in Ireland since then and may survive in the region of the quarry. It requires open grassy areas to nest so again would not be associated with the extension area.

3.2.2.4 EVALUATION

The proposed quarry extension area supports the typical flora and fauna of arable fields in the area and has no special habitat features. Some of the hedges are used by yellowhammers but these are generally widespread in cereal growing areas of eastern Ireland. The bird is of moderate conservation concern because of a loss of national population (Newton *et al* 1999).

Other parts of the overall site area do have significant interest in their flora and fauna, particularly the less frequented ground around the railway line, at the NW corner and along the western edge of the current extraction area. Small areas of limestone grassland here hold a diversity of plants that are relatively rare in the county as a whole (Preston *et al* 2002) and largely restricted to quarries. They include blue fleabane *Erigeron acer*, carline thistle *Carlina vulgaris*, rest harrow *Ononis repens* and yellow wort *Blackstonia perfoliata*. A varied insect fauna is likely to be dependant on these areas.

Designations

The stream valley at the NW corner of the site and some of the adjacent grassland is included in the River Barrow and River Nore candidate SAC (Code No 2162). This does not extend to the proposed extension area in the SE which has little if any connection with the main valley.

There are no plants listed under the Flora Protection Order 1999. The blue fleabane was included in the Red Data Book (Curtis and McGough 1988) but is not rare in the Carlow/Kilkenny area.

3.2.3 ASSESMENT OF POTENTIAL IMPACTS

3.2.3.1 DIRECT IMPACTS

Quarrying removes pre-existing habitat since it involves the stripping of overburden before rock extraction. After it ceases however, the natural colonisation of the area and surroundings often produces an interesting ecology, particularly in nutrient-poor areas without topsoil. An alternative in some cases is for the site to be restored to agricultural use but this results in the loss of much of the biodiversity.

The direct impacts of this development will be the loss of parts of five tillage fields to quarrying, together with the hedges between them. No extraction is planned in the western section around the haggard/trees. Screening berms of topsoil / overburden will be created along the perimeter of the extraction area. Extracted and processed stone will be transported to the existing processing / ancillary area using the existing internal haul road, refer to EIS Figure 2.6.

Fugitive dust (above the IPPC Licence threshold limit) may have an impact on evergreen and other vegetation beside the roadways and process area.

3.2.3.2 INDIRECT IMPACTS

The loss of agricultural crops will bring about a reduction or re-adjustment in local yellowhammer populations but this is unlikely to be as significant as changes in farming use.

Due to the separation distance (over 400 metres) no significant impact on the nearby cSAC is envisaged.

3.2.4 MITIGATION MEASURES

Environmental emissions from the existing development (dust, noise, water) are regulated by the existing IPPC licence (Licence No. 521) issued by the Environmental Protection Agency. There is an existing environmental monitoring programme and existing environmental control measures in place to mitigate and monitor emissions to air and water (River Nore). The Applicant has applied for a revision to this licence to incorporate the proposed quarry extension area.

Existing external perimeter hedgerows will be retained. Where removal of internal hedgerows is required this work shall only be carried out during the period September to March.

Only native species of tree and shrub will be planted around the site so as to maximise their food and cover value for wildlife. Native tree and shrub species are:

- Trees:
- i) Ash (*Fraxinus excelsior*)
 - ii) Oak (*Quercus robur*)
 - iii) Goat (*Willow Salix caprea*)
 - iv) Grey (*Willow Salix cinerea*)
 - v) Aspen (*Populus tremula*)
 - vi) Wild Cherry (*Prunus avium*)
- Shrubs:
- i) Hazel (*Corylus avellana*)
 - ii) Hawthorn (*Crataegus monogyna*)
 - iii) Blackthorn (*Prunus spinosa*)
 - iv) Common gorse (*Ulex europaeus*)

Restoration work will be done with ecological advice so as to retain as many habitat variations and species as possible.

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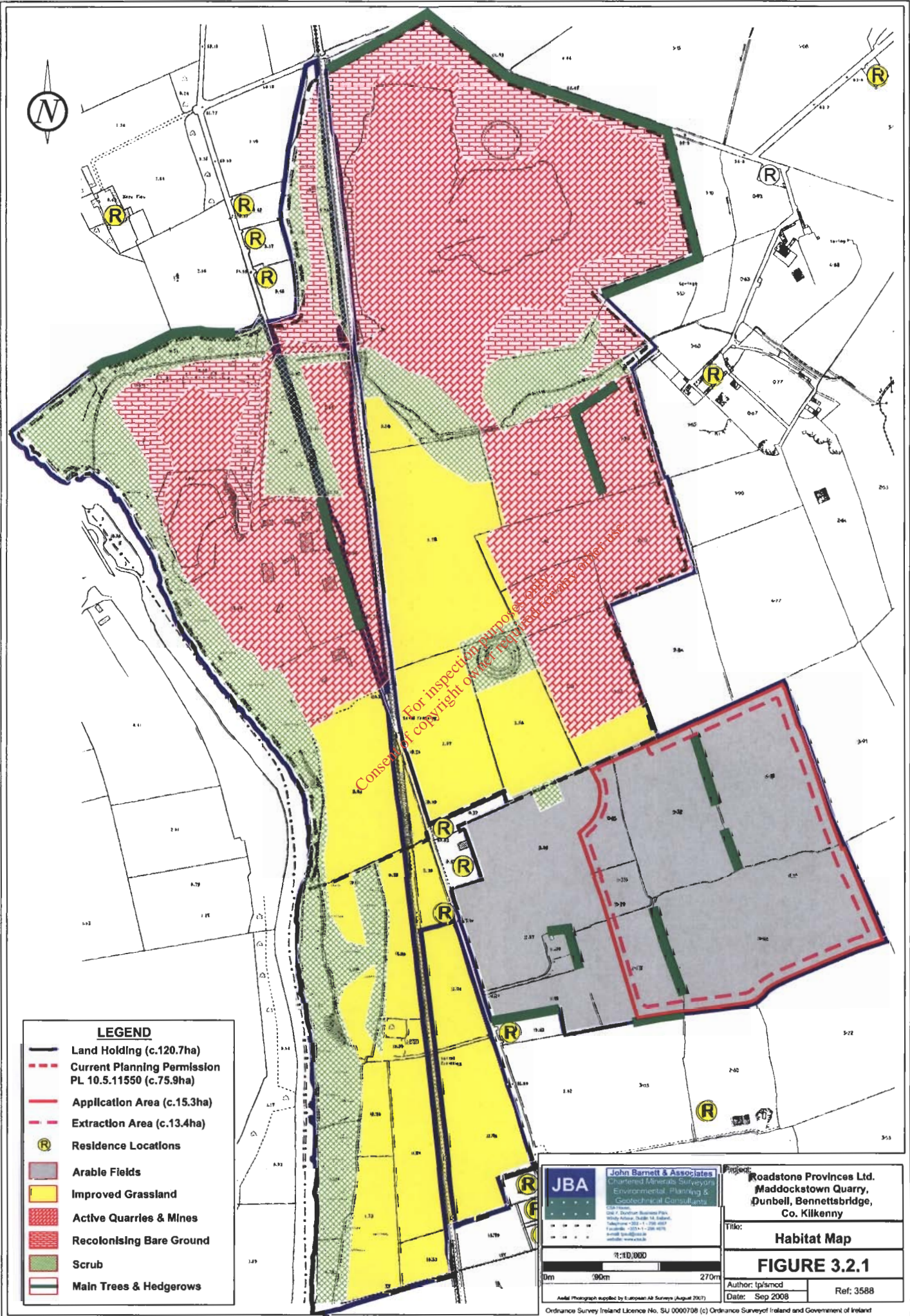
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SECTION 3.2 - FIGURES

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SECTION 3.3 – SOILS AND GEOLOGY

CONTENTS

3.3.1 INTRODUCTION

3.3.2 BASELINE ENVIRONMENTAL STUDY

- i. Outline of the Baseline Study**
- ii. Baseline Study Methodology**
- iii. Regional Geology**
 - a. Soils**
 - b. Superficial Deposits**
 - c. Bedrock Geology**
- iv. Local Geology**
 - a. Introduction**
 - b. Superficial Deposits**
 - c. Bedrock Geology**
 - d. Structure**
 - e. Weathering**
 - f. Geological Heritage**
 - g. Rock Mass, Mineralogy and Engineering Characteristics**
 - i) Introduction**
 - ii) Rock Mass**
 - iii) Mineralogy and Engineering Characteristics**
 - iv) Aggregate Testing**

3.3.3 ASSESSMENT OF IMPACTS

- i. Direct Impacts**
- ii. Indirect Impacts**

3.3.4 MITIGATION AND MONITORING

- i. Soils**
- ii. Geology**

FIGURES

- Figure 3.3.1. Distribution of superficial deposits at Maddockstown and surrounding areas. From Teagasc sub-soil parent material mapping.
- Figure 3.3.2. Bedrock geology of Maddockstown and surrounding areas. From GSI 1:100,000 sheet 19 Geology of Carlow - Wexford.
- Figure 3.3.3. Site plan showing detailed distribution of geological regions, site investigation locations and cross section lines.
- Figure 3.3.4. Cross Section A – A'
- Figure 3.3.5. Cross Section B – B'
- Figure 3.3.6. Cross Section C – C'
- Figure 3.3.7. Cross Section D – D'

PLATES

- Plate 3.3.1. View looking north at quarry faces showing limestones of the Butlersgrove Formation replaced by pink/buff dolomite.
- Plate 3.3.2. View to northeast showing contact between buff dolomite “plume” and adjacent/underlying black dolomitised limestones of the Butlersgrove Formation.

APPENDICES

- Appendix 3.3.1. Correspondence with the Geological Survey of Ireland in relation to geological heritage issues.
- Appendix 3.3.2. Borehole logs – JBA Rotary Percussive Drilling 2004 and 2007.
- Appendix 3.3.3. Analytical results from borehole sampling – Quigley Magnesite Rotary Coring and JBA Rotary Percussive Drilling 2004 and 2007

3.3.1 INTRODUCTION

This section of the EIS involves an evaluation of the existing geological setting on both a local and regional scale, an assessment of the impact of the development on the geological features of the area and other geological aspects of the development. It is based on a desk study of the selected area and its surroundings and geological investigation in the existing quarry and on adjacent lands. It was prepared by John Barnett and Associates in accordance with guidelines on Geology in Environmental Impact Statements issued by the Institute of Geologists in Ireland and is in compliance with the objectives outlined by Section 8.4 of the Kilkenny County Council Development Plan 2002.

Personnel involved in the assessment were:

EurGeol Dr. John Kelly PGeo, MIMMM, MIQ (Professional Geologist)

Consultation with, and examination of documentation and archive material, were made from: Geological Survey of Ireland (GSI), Beggars Bush, Haddington Rd, Dublin 4.

3.3.2 BASELINE STUDY

i. Outline of the Baseline Study

Available literature and databases relating to the bedrock and superficial deposit geology of the Maddockstown area and surrounding areas was collated and evaluated. Following this data compilation and review, a number of site visits were undertaken to review the bedrock geology and superficial deposits in the existing quarry and adjacent lands.

ii. Baseline Study Methodology

The following were undertaken to allow a geological assessment to be completed

- An examination of all available geological literature.
- Examination of GSI 1:100,000 geology map sheet and memoir, 19, Geology of Carlow - Wexford.
- Site inspection to assess the local geological setting
- Review of previous work undertaken at Maddockstown.

iii. Site Description

Maddockstown Quarry is situated north of the town of Bennetsbridge, Co. Kilkenny. The quarry is located in an area of slightly elevated ground 1km to the east of the Nore River.

The current working area is located at the northern end of the lands in question. A new extraction area for which planning permission has been granted is being developed to the south of the existing extraction area. An area to the south of this new extraction area is the subject of a planning application. These southern areas are referred to as the southern extraction area.

Regional Geology

a) Soils

The Royal Irish Academy Atlas of Ireland (1979) Soils map shows the Maddockstown area to be underlain by gley soils derived from Carboniferous limestone tills and gravelly drift.

b) Superficial Deposits

Teagasc sub-soil parent material mapping (Figure 3.3.1) indicates that the site is underlain by sands and gravels derived from Carboniferous Limestones, glacial tills derived from Carboniferous Limestones and bedrock at or near surface.

c) Bedrock Geology

The Geological Survey of Ireland 1:100,000 geology Sheet 19 (Geology of Carlow – Wexford) indicates that the site is underlain by limestones and dolomitised limestones of the Butlersgrove Formation (Figure 3.3.2).

The dolomitisation of the limestones in this area appears to be related to a major north – south oriented fault which downthrows to the west and faults the Butlersgrove Formation to the east against the Ballyadams Limestone Formation to the west. The trend of the dolomitisation in this area is sub-parallel to this major structure. In the Maddockstown area, the dolomitised limestones pass to the east into undolomitized Butlersgrove Formation. The Butlersgrove Formation is underlain to the south by the Ballysteen Limestone Formation and overlain to the north by the Ballyadams Limestone Formation.

Structural information indicates that the sequence dips to the northwest. The geological sequence is summarised in Table 3.3.1.

AGE	STAGE	FORMATION
Carboniferous	Asbian	Ballyadams Limestone Formation
	Chadian - Holkerian	Butlersgrove Formation
	Courseyan	Ballysteen Limestone Formation

Table 3.3.1. Bedrock Geology sequence in the Maddockstown Area.

iv. Local Geology

a) Introduction

A detailed assessment of the local geology has been undertaken. This assessment involved detailed site inspection, literature review and a review of previous geological work undertaken at Maddockstown.

A considerable amount of ground investigation of varying quality has been undertaken at Maddockstown since the 1960's. This work has largely comprised rotary cored and rotary percussive (RP) drilling and geophysical surveying. The most useful data is that obtained from rotary coring in the late 1960s/early 1970s and rotary percussive drilling undertaken by JBA where drilling return was logged and sampled by a geologist and chemically analysed.

Rotary coring undertaken in the late 1960's and early 1970's by the Quigley Magnesite Company is particularly valuable, as a number of the cored holes were logged in detail and were also analysed to determine their dolomite content. Relevant boreholes are Q101 to Q109 and Q116 to Q123 which totalled 629m.

Much of the rotary percussive drilling which has been undertaken has been directed towards determining overburden thickness and provided little information on lithological distributions.

A programme of RP boreholes undertaken in 2004 to determine the extent of dolomitisation in lands south of the existing quarry (RP-01 to RP-08 for 192m) and to allow installation of additional groundwater monitoring installations in 2007 (GW08 – GW12 for 265.3m) are also particularly useful as returns from these boreholes were logged by geologists and were also sampled and chemically analysed.

The geological interpretation of the geology of the Maddockstown area is therefore based on inspection of rock exposures in the existing quarry and data from those boreholes where quality lithological data has been obtained, i.e., the Quigley Magnesite rotary coring and the 2004 and 2007 RP drilling.

Borehole logs for the 2004 and 2007 RP drilling are presented in Appendix 3.3.2. Summary lithological data for the 1960's and 1970's Quigley rotary coring are also presented in Appendix 3.3.2. Analytical data for the Quigley rotary coring and the 2004 and 2007 RP drilling are presented in Appendix 3.3.3. A detailed site geology map showing borehole locations are presented in Figure 3.3.3 and cross-sections through the area are presented in Figures 3.3.4 to 3.3.7.

b) Superficial Deposits

Superficial deposits at the site are composed of thin soils overlying bedrock or thin glacial tills in the northern part of the site, with thin soils overlying glacial tills to the south of the existing quarry.

The glacial till thickness has been largely determined by RP drilling. Overburden data was compiled for 72 boreholes in total and averages 3.78m across the area of the existing quarry, the proposed extension area and adjacent lands.

Within the proposed extension to the south of the existing quarry, data from 58 boreholes indicates that overburden thickness averages 3.82m, with a maximum thickness of 13.8m and a minimum of 0.3m.

c) Bedrock Geology

The current extraction area at Maddockstown Quarry is developed within dolomitised limestones of the Butlersgrove Formation. In the northern part of the existing extraction area, and the old workings located to the west of the road and railway, the dolomites are largely composed of

coarse, pale cream, pink or buff coloured dolomites (which are dark grey where the original limestone had an argillaceous component).

These buff dolomites pass abruptly into grey to dark grey to black, coarse to medium-grained dolomitised limestones within the current working area. The contact between the coarse buff dolomites and the grey/black dolomites is oriented approximately 015° with the buff dolomite to the northwest and the black dolomites to the southeast. The contact area is sub-vertical, but changes rapidly to a horizontal contact with a thin layer of buff dolomite overlying the grey/black dolomites.

Review of existing quarry faces and relevant boreholes indicates that the proposed southern extraction area is underlain by either thin dolomites overlying limestones with minor dolomitised limestone, or limestone with minor dolomitised limestone.

d) Structure

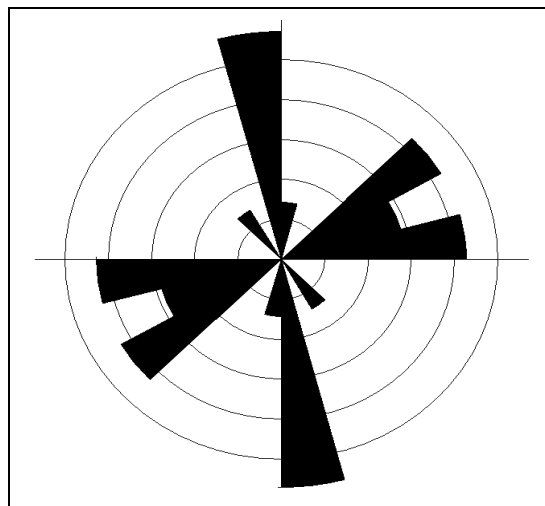
Maddockstown Quarry lies immediately east of a major north – south oriented normal fault with a large downthrow, probably of several 100s of metres, to the west. The sequence overall has a regional shallow dip to the north or northwest.

Examination of quarry faces and dip measurements within the quarry indicate that the bedding within the quarry dips at 8° to the west in the northern part of the quarry, changing gradually to a dip of 9° or 10° to the southwest or south-southwest in the southern part of the quarry.

A number of small faults have been identified within the quarry oriented approximately 007° ; these appear to consistently downthrow to the east, are probably related to the major structure identified to the west of the quarry and may exert a significant control on the distribution of dolomitisation within the Butlersgrove Formation in the Maddockstown area.

Measurement of discontinuities (jointing) within the existing quarry indicates the presence of three joint sets, one oriented just west of north (approximately 355°) and sub-vertical to vertical. The second joint set is oriented 160° and is sub-vertical to vertical, the third set is oriented approximately 175° and dips from 75° to 80° .

Discontinuity data from 14 readings is presented in the discontinuity plot below.



Plot 3.3.1. Rose diagram of discontinuity data from Maddockstown Quarry.

e) Weathering

Where dark grey or black dolomitised limestone is present beneath the superficial deposits, a thin zone of rock may be weathered to a brown dolomite. Apart from this, no other significant weathering of the rock mass has been observed and no karstification has been identified.

f) Geological heritage

The Geological Survey of Ireland (GSI) Irish Geological Heritage (IGH) programme was contacted to determine if any geological heritage issues were present in relation to the proposed development. Correspondence is presented in Appendix 3.3.1.

The GSI note that Maddockstown Quarry is on their indicative list of geological heritage sites as a very good example of dolomitised limestone (Butlersgrove Formation) in the Kilkenny area, under the IGH8 Lower Carboniferous Theme (or possibly under the IGH15 Economic Geology Theme). GSI have therefore recommended the quarry for County Geological Site (CGS) status.

GSI state that there are no management issues in relation to the proposed development. IGH request that the quarry operator notify IGH of any obviously new or different geological sections or features revealed through blasting and that a representative section of the geology is preserved at the end of the quarrying operation.

g) Rock Mass, Mineralogy and Engineering Characteristic**i) Introduction**

Previously, the buff dolomite was extracted and used for fertiliser manufacture by Irish Fertiliser Industries (IFI) and the grey dolomites were used for general aggregates as the grey dolomite is chemically unsuitable for fertiliser production. Currently, the grey dolomites are used for aggregate production and, due to the closure of the IFI facility, the buff dolomite is used as low-grade fill material.

The grey dolomite is suitable for a wide range of aggregate uses and the grey dolomites and limestone to be extracted from the southern extraction area will be suitable for a wide range of aggregate uses.

ii) Rock Mass

Rock mass properties for the rock types extracted at Maddockstown are generally excellent. The grey dolomites provide good quality aggregates.

iii) Mineralogy and Engineering Characteristics

Rock currently extracted at Maddockstown from the northern extraction area is composed of small quantities of low aggregate value buff dolomite, with the bulk of the material extracted composed of grey dolomites which provide good quality aggregate.

The proposed southern extraction area will be developed within thin buff or grey dolomites overlying undolomitized limestones of the Butlersgrove Formation. These limestones will produce aggregate of similar or superior quality to the grey dolomites derived from dolomitisation of the Butlersgrove Limestones.

iv) Aggregate Testing

A range of aggregate tests are routinely conducted on aggregates produced by Roadstone Provinces Ltd. at Maddockstown to ensure that aggregates produced are of suitable standard.

A summary of recent aggregate test results are presented in Table 3.3.3.

TEST	Value
Aggregate Crushing Value	23%
10% Fines Value	160kN
Micro Deval (Mde)	21
Density	2.83Mg/m3
Water Absorption	0.7%
Los Angeles Coefficient (LA)	27.2 – 28.8

Table 3.3.3 Recent Aggregate Test results from Maddockstown aggregate.

Aggregate tests show that the grey dolomites provide a strong durable aggregate suitable for a wide range of uses. Petrographic examination of the aggregate material indicates that it contains no deleterious minerals etc., and is therefore suitable for use in concrete product manufacture.

Although the rock is a dolomitised limestone, and would be expected to have an increased porosity and permeability, water absorption tests show a water absorption result of 0.7%, typical of many limestone aggregates and within the limits for quality aggregate.

3.3.3 ASSESSMENT OF IMPACTS

i. Direct Impacts

The nature of the development will entail the removal and placement of soil and overburden and subsequent excavation of sands and gravels. Thus there will be a short-term impact on the overlying soil / overburden strata, and a direct impact on the existing in situ sand and gravel deposits.

ii. Indirect Impacts

The development will not have an indirect impact on the geological aspects of the environment outside the footprint of the pit. Groundwater impacts are addressed in Section 3.4.

3.3.4 MITIGATION AND MONITORING

i. Soils

The proposed extraction area will have a long-term land take of up to 15 hectares. Any remaining topsoil / subsoil and overburden material will be removed and then used:

- To create screening berms around the perimeter of the site.
- For phased restoration of the upper quarry face when the final quarry extension limits are reached.
- For final restoration of the worked out quarry area

To limit the effects of erosion on these materials the following measures will be adopted.

- Where ever these materials are placed in either permanent or temporary locations, an angle of repose of no greater than 1: 1.5 will be used. This is considered the maximum acceptable slope to limit excessive erosion of the material, and also limit any visual impact.
- The surface of final restoration areas will be seeded / re-vegetated as soon as is practical after placement.
- Re-handling of material will be minimised as much as possible in order to preserve the integrity of the topsoil material. This is also an economically prudent practice.

ii. Bedrock

Quarrying of aggregate material, by definition, requires the excavation and removal of rock material, thereby producing a permanent impact on the local bedrock environment within the extraction area.

The final land restoration scheme will ultimately allow the site to be returned to a condition whereby there will be negligible residual impact on the surrounding environment due to the removal of rock material within the quarry. It is planned to minimise, eliminate or decrease long-term ecological, visual, hydrological and hydro-geological impacts on the environment through the implementation of the final restoration scheme.

Extraction of bedrock will provide additional exposures of the complex geology at Maddockstown, providing potential for further academic research into the processes of dolomitisation which have been revealed by the ongoing extraction.

The Applicant will comply with the recommendations of the Geological Survey of Ireland (GSI) in relation to geological heritage, as follows:

- Notify the GSI of any obviously new / different geological sections or features revealed through blasting.
- Incorporate / retain a representative section of the geology into the final restoration scheme for the quarry.

REFERENCES

Tietzsch-Tyler, D. and Sleeman, A.G. 1994. Geological Survey of Ireland 1:100,000 Sheet 19, Carlow – Wexford and accompanying geological memoir.

SECTION 3.3 – FIGURES

- Figure 3.3.1. Distribution of superficial deposits at Maddockstown and surrounding areas. From Teagasc sub-soil parent material mapping.
- Figure 3.3.2. Bedrock geology of Maddockstown and surrounding areas. From GSI 1:100,000 sheet 19 Geology of Carlow - Wexford.
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- Figure 3.3.4. Cross Section A – A'
- Figure 3.3.5. Cross Section B – B'
- Figure 3.3.6. Cross Section C – C'
- Figure 3.3.7. Cross Section D – D'

SECTION 3.3 – PLATES

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Plate 3.3.1. View looking north at quarry faces showing limestones of the Butlersgrove Formation replaced by pink/buff dolomite.

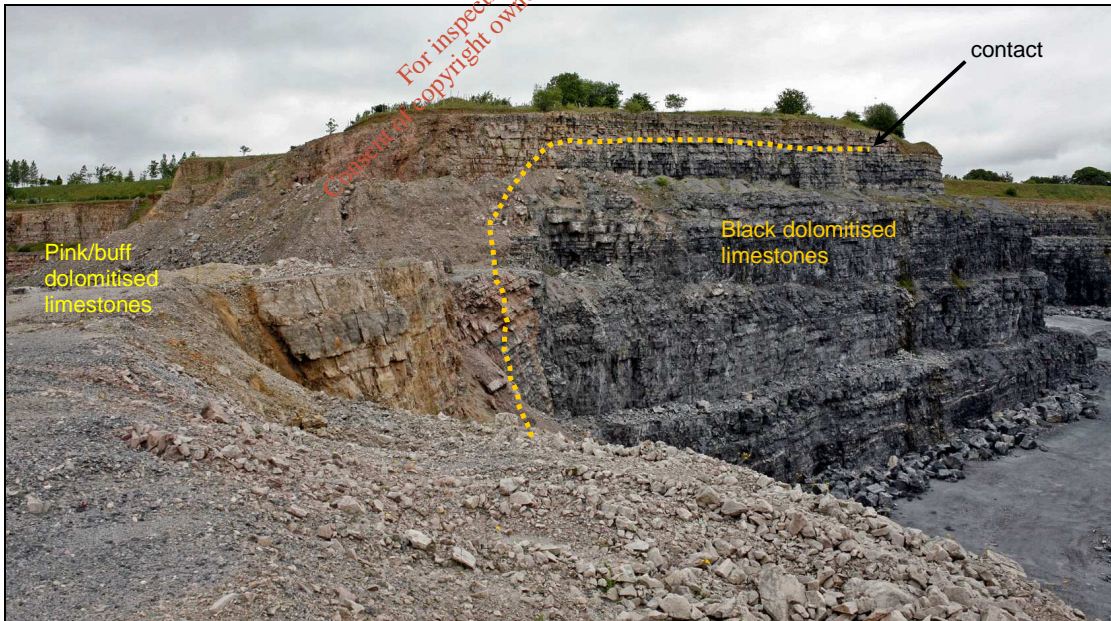


Plate 3.3.2. View to northeast showing contact between buff dolomite “plume” and adjacent/underlying black dolomitised limestones of the Butlersgrove Formation.

SECTION 3.3 – APPENDICES

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APPENDIX 3.3 – A

CORRESPONDENCE WITH THE GEOLOGICAL SURVEY OF IRELAND IN RELATION TO GEOLOGICAL HERITAGE ISSUES.

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APPENDIX 3.3 – B

BOREHOLE LOGS

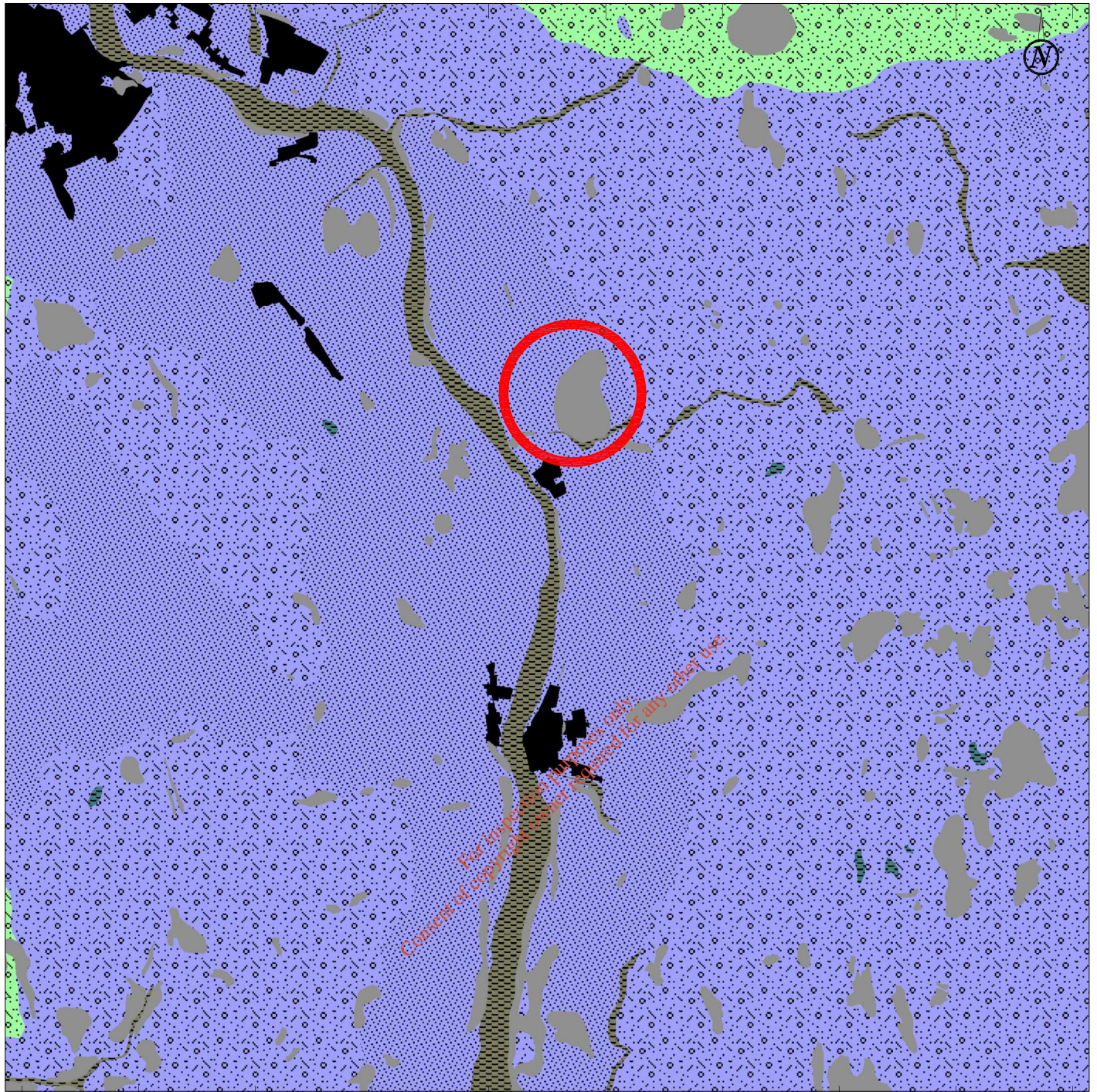
JBA ROTARY PERCUSSIVE DRILLING 2004 AND 2007.

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APPENDIX 3.3 – C

ANALYTICAL RESULTS FROM BOREHOLE SAMPLING – QUIGLEY MAGNESITE ROTARY CORING AND JBA ROTARY PERCUSSIVE DRILLING 2004 AND 2007









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Legend

 Site Location

SUPERFICIAL DEPOSITS SUB-SOIL PARENT MATERIAL TYPE

	Alluvium
	Lacustrine Sediments Undifferentiated
	Sand and Gravel - Namurian Sandstones and Shales
	Sand and Gravel - Carboniferous Limestones
	Till - Namurian Clasts
	Till - Carboniferous Limestone Clasts
	Outcrop & Subcrop
	Made Ground

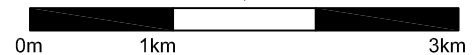
JBA



JOHN BARNETT & ASSOCIATES
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN 14

Extract from 1:100,000 GSI Geology of Carlow - Wexford Sheet 19

1:50,000



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Site: Kilkenny Limestone Ltd.; Kellymount Quarry
Existing Quarry at Dunbell, Bennettsbridge, Co. Kilkenny

Title: Regional Geology

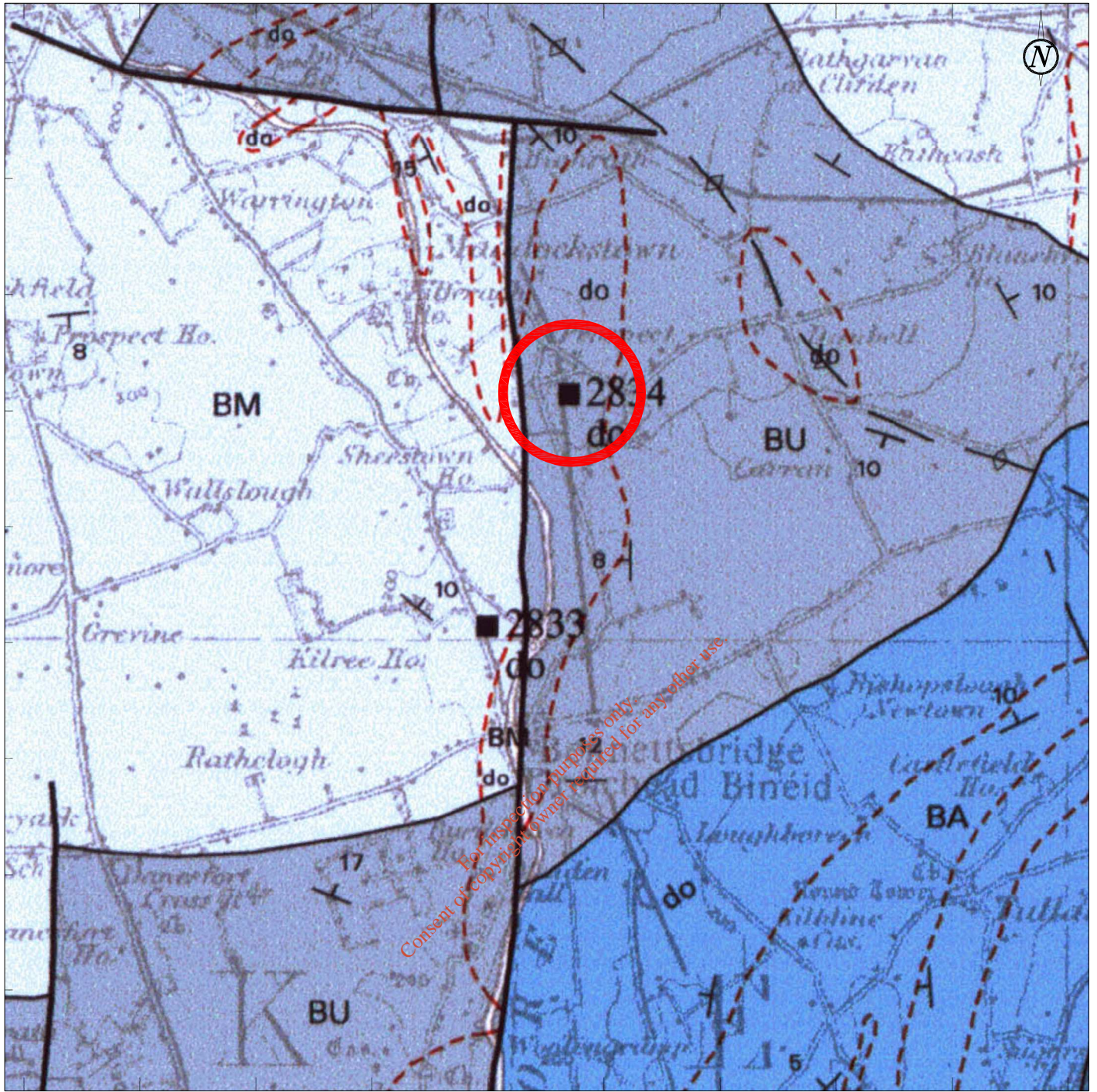
Drawn: jk/smcd

Scale: 1: 50,000

Job. No: 3588

Date: Sep 2008

Figure 3.3.1



Legend

 Site Location

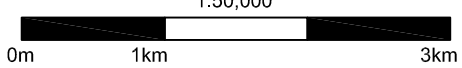
CQ	Coolbaun Formation Shale and sandstone with thin coals
SS	Swan Sandstone Member Laminated dark-grey siliceous sandstone
CG	Clay Gall Sandstone Formation Feldspathic quartzitic sandstone
MC	Moyadd Coal Formation Shale, siltstone & minor sandstone
BE	Bregaun Flagstone Formation Thick flaggy sandstone and siltstone
KN	Killeslin Siltstone Formation Muddy siltstone & silty mudstone
LS	Luggacurren Shale Formation Mudstone & shale with chert & limestone
CL	Clogrenan Formation Cherty, muddy, calcarenitic limestone
BM	Ballyadams Formation Crinoidal wackestone/packstone limestone
MI	Milford Formation Peloidal calcarenitic limestone
BU	Butlersgrove Formation Very dark grey argillaceous limestones
WX	Wexford Formation Pale grey limestones, often dolomitised
WA	Waulsortian Limestones Massive unbedded fine-grained limestone
BA	Ballysteen Formation Fossiliferous dark-grey muddy limestone
BT	Ballymartin Formation Limestones & dark grey calcareous shale
QU	Quinagh Formation Lenticular mudstone & coarse siltstone



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Extract from 1:100,000 GSI Geology of Carlow - Wexford Sheet 19

1:50,000



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Site:	Kilkenny Limestone Ltd.; Kellymount Quarry Existing Quarry at Dunbell, Bennettsbridge, Co. Kilkenny	
Title:	Regional Geology	
Drawn:	jk/smcd	Scale: 1: 50,000
Job. No:	3588	Date: Sep 2008
		Figure 3.3.2

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255,750

256,000

256,250

152,250

152,000

151,750

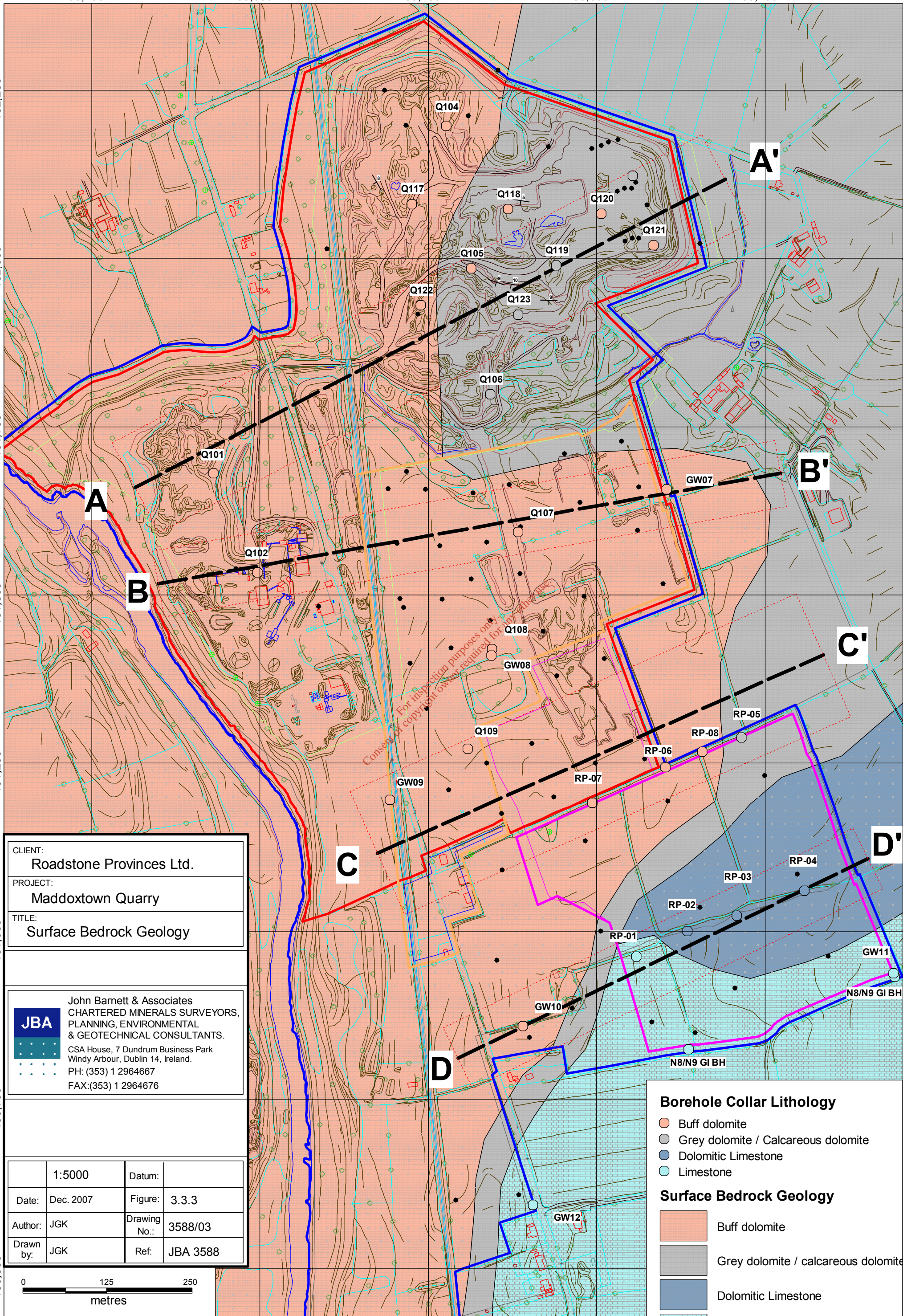
151,500

151,250

151,000

150,750

150,500



CLIENT:
Roadstone Provinces Ltd.

PROJECT:
Maddoxtown Quarry

TITLE:
Surface Bedrock Geology

JBA John Barnett & Associates
CHARTERED MINERALS SURVEYORS,
PLANNING, ENVIRONMENTAL
& GEOTECHNICAL CONSULTANTS.

CSA House, 7 Dundrum Business Park
Windy Arbour, Dublin 14, Ireland.
PH: (353) 1 2964667
FAX:(353) 1 2964676

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Date:	Dec. 2007	Figure:	3.3.3
Author:	JGK	Drawing No.:	3588/03
Drawn by:	JGK	Ref:	JBA 3588

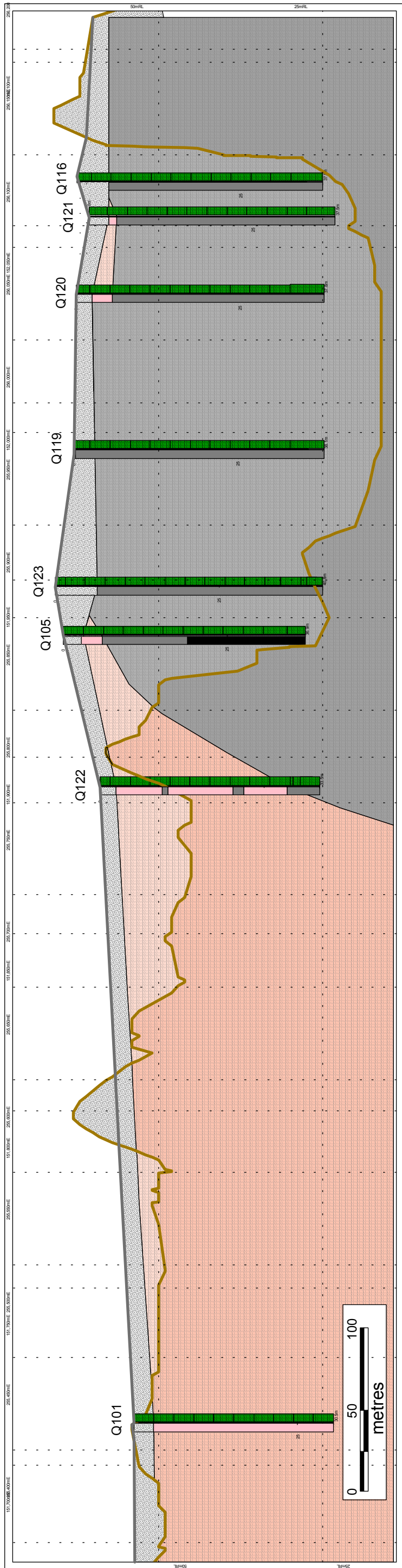


- Borehole Collar Lithology**
- Buff dolomite
 - Grey dolomite / Calcareous dolomite
 - Dolomitic Limestone
 - Limestone
- Surface Bedrock Geology**
- Buff dolomite
 - Grey dolomite / calcareous dolomite
 - Dolomitic Limestone

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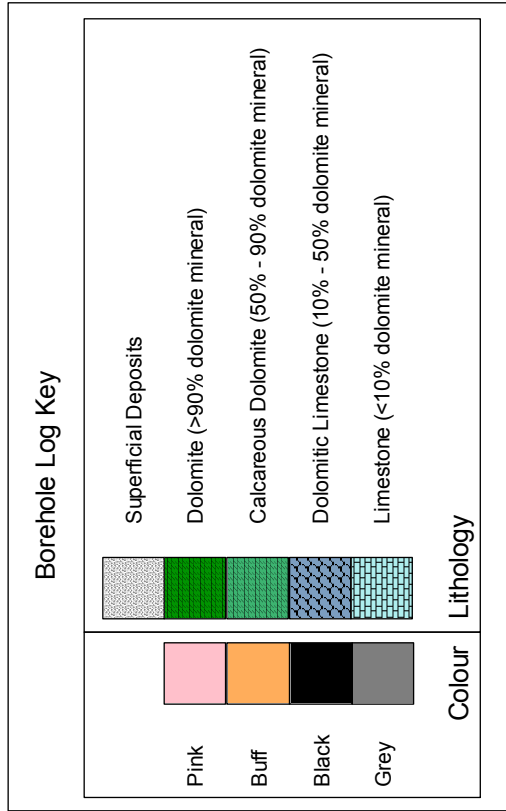
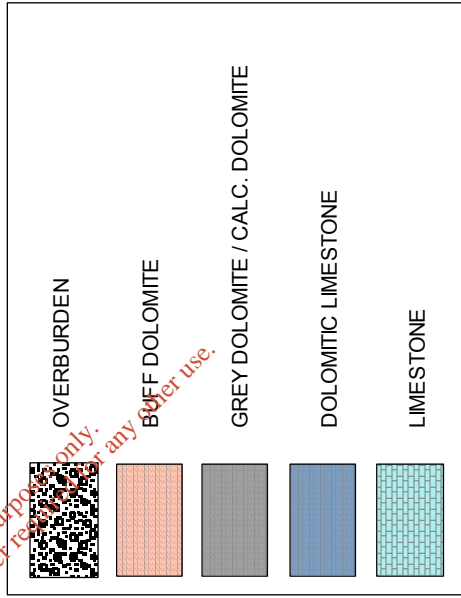
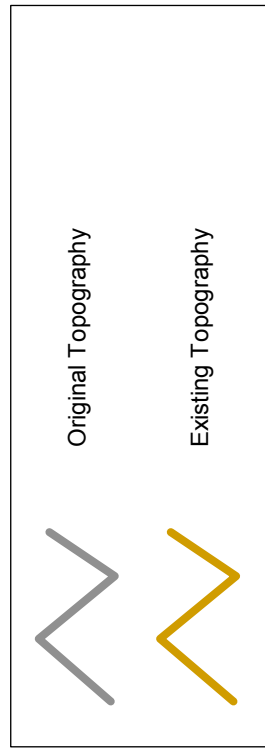
A


A'



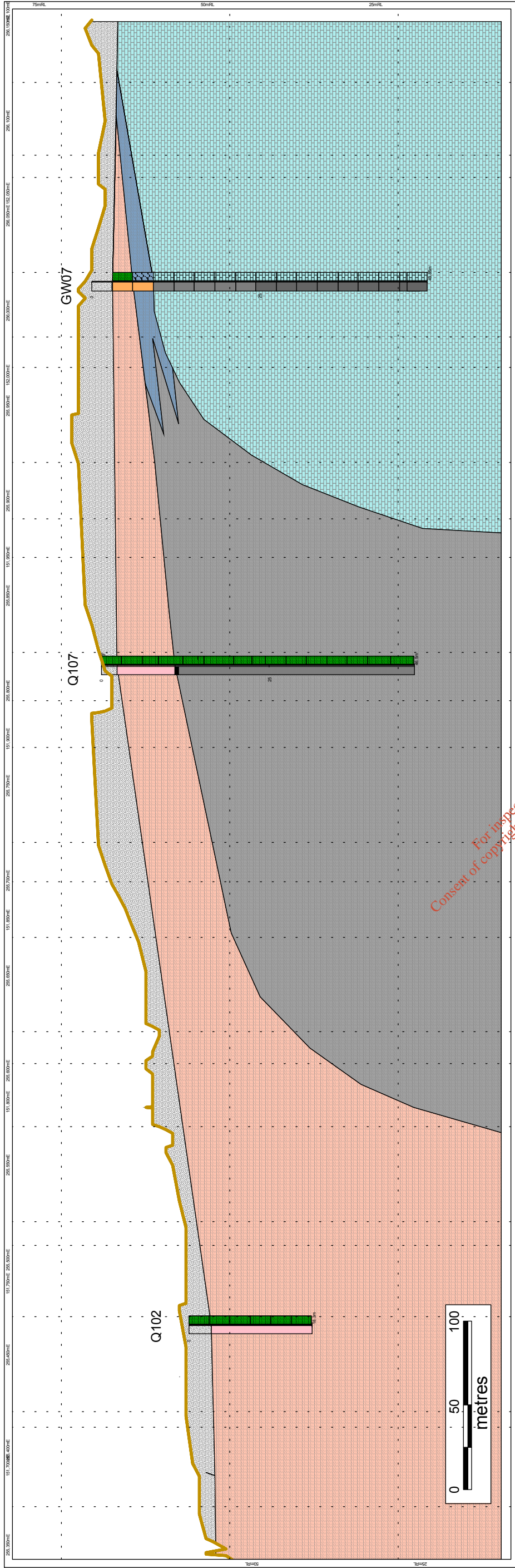
Vertical Exaggeration X4

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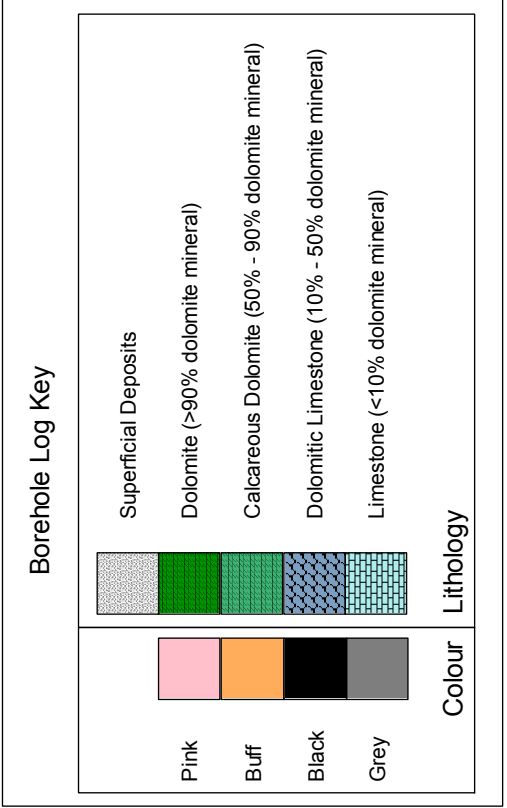
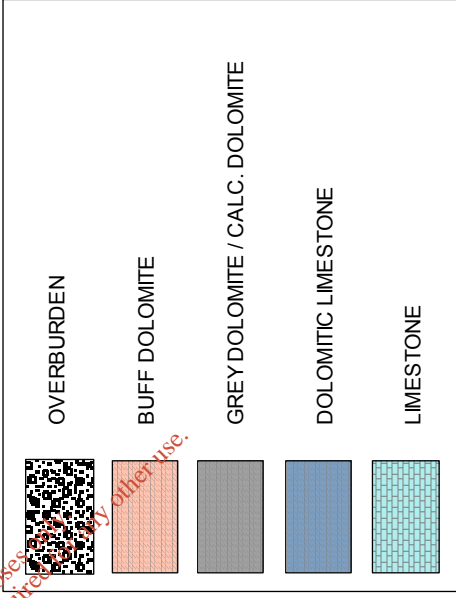



CLIENT:	Roadstone Provinces Ltd.
PROJECT:	Maddoxtown Quarry
TITLE:	Cross - Section A - A'
 John Barnett & Associates CHARTERED MINERALS SURVEYORS, PLANNING, ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS. CSA House, 7 Duncrum Business Park Windy Arbour, Dublin 14, Ireland. PH: (353) 1 2964667 FAX:(353) 1 2964676	
Date:	Dec. 2007
Author:	JGK
Drawn by:	JGK
Datum:	
Figure:	4
Drawing No.:	3588/04
Ref:	

B'

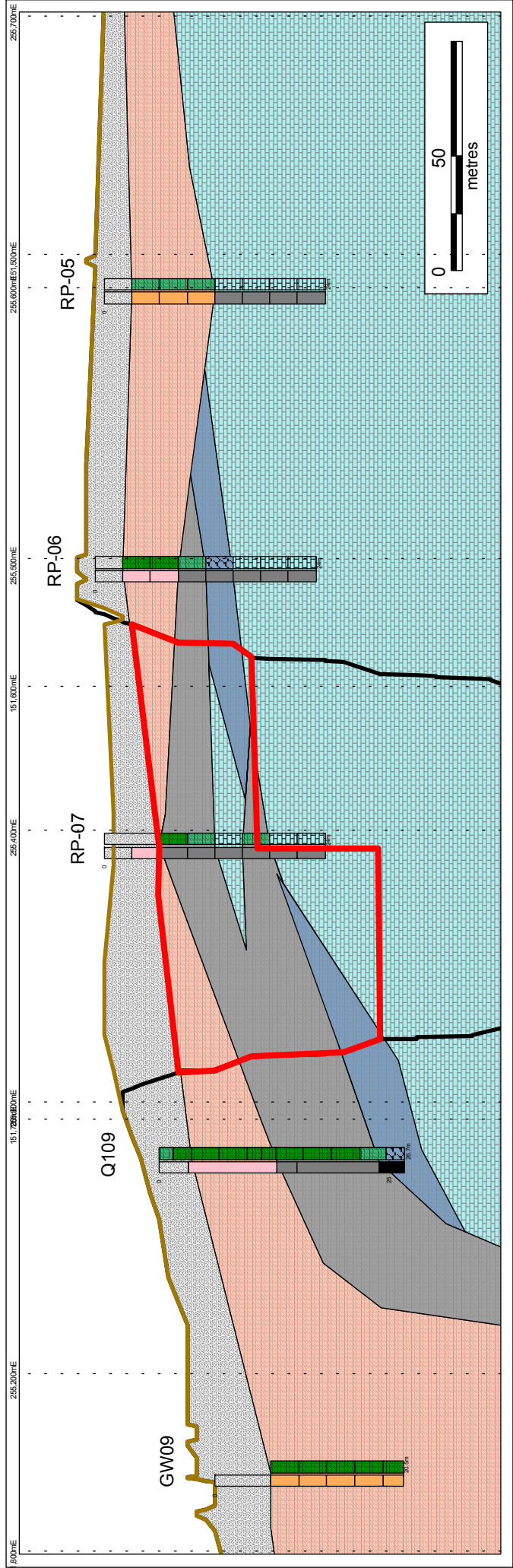


Vertical Exaggeration X4



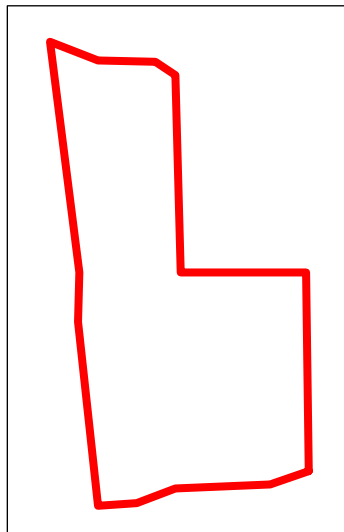
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PROJECT:	Maddoxtown Quarry
TITLE:	Cross - Section B - B'
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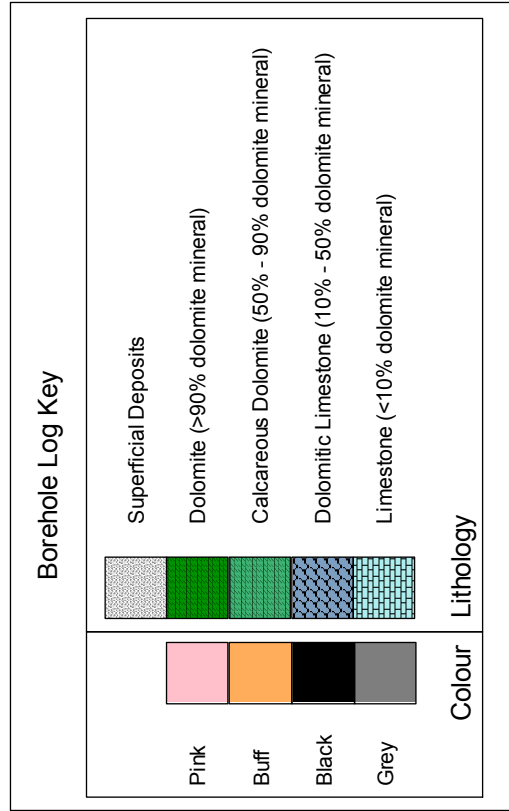
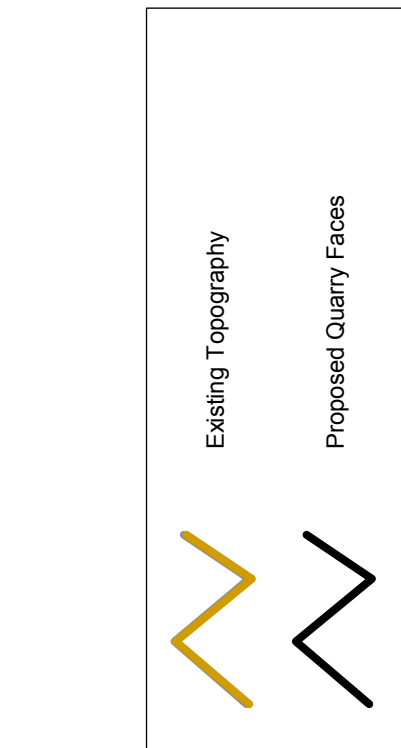
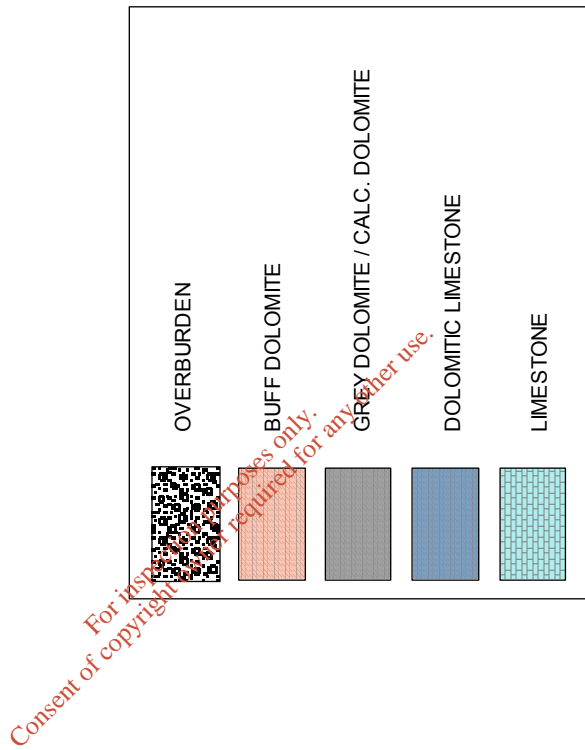


C'

Vertical Exaggeration X4



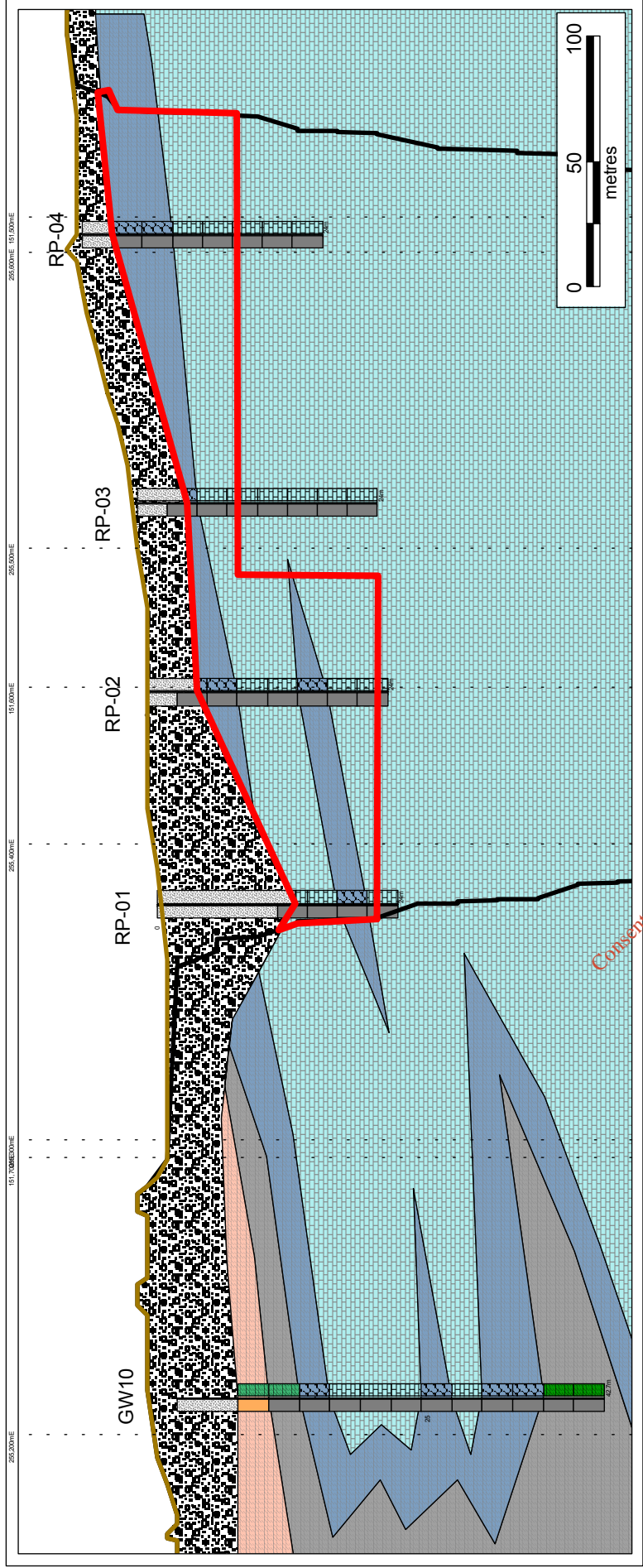
Resource area containing scheduled minerals



CLIENT:	Roadstone Provinces Ltd.		
PROJECT:	Maddoxtown Quarry		
TITLE:	Cross - Section C - C'		
<p>John Barnett & Associates CHARTERED MINERALS SURVEYORS, PLANNING, ENVIRONMENTAL & GEOTECHNICAL CONSULTANTS. CSA House, 7 Dundrum Business Park Windy Arbour, Dublin 14, Ireland. PH: (353) 1 2964667 FAX:(353) 1 2964676</p>			
Date:	Dec. 2007	Datum:	
Author:	JGK	Figure:	6
Drawn by:	JGK	Drawing No.:	3588/06
		Ref:	

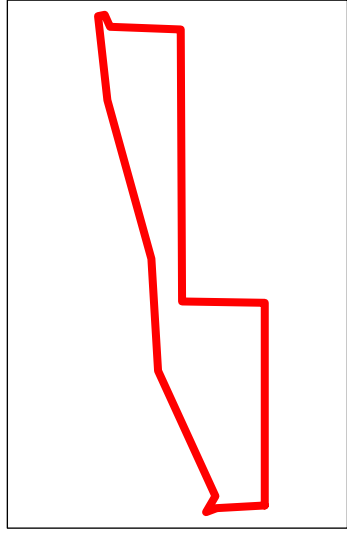
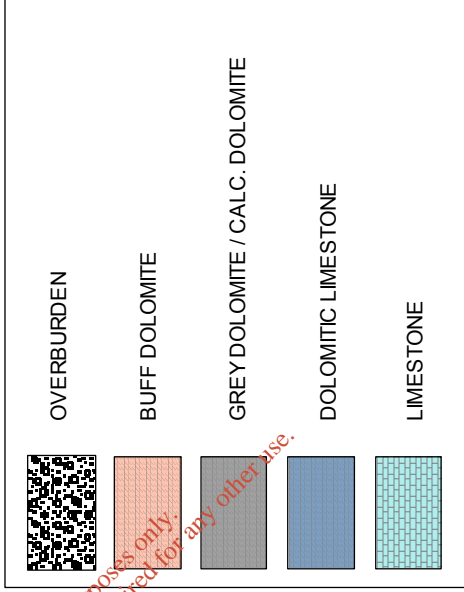
D

D'

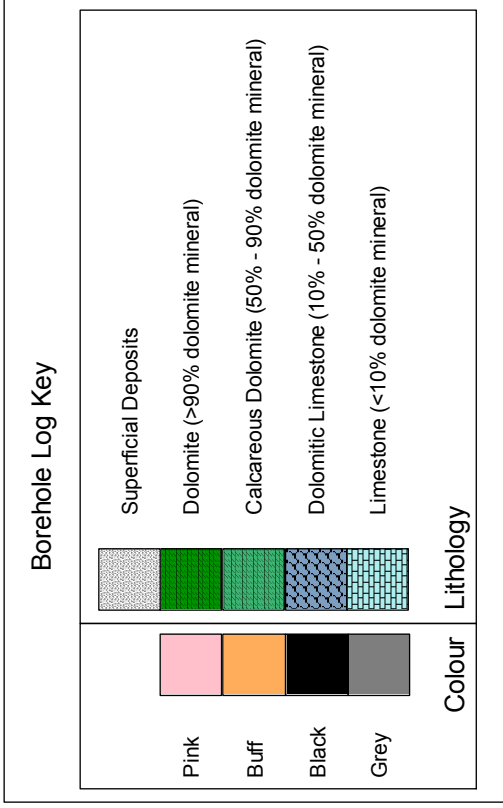
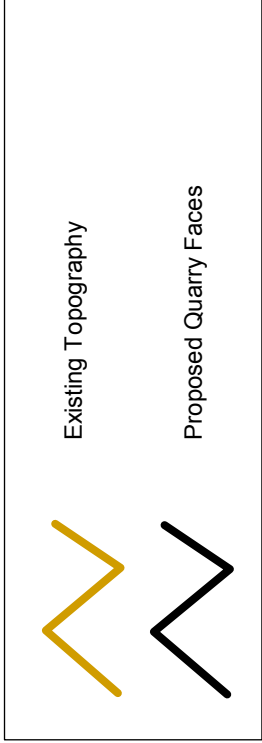



Vertical Exaggeration X4

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Resource area containing scheduled minerals



CLIENT:	Roadstone Provinces Ltd.		
PROJECT:	Maddoxtown Quarry		
TITLE:	Cross - Section D - D'		
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Date:	Dec. 2007	Datum:	
Author:	JGK	Figure:	7
Drawn by:	JGK	Drawing No.:	3588/07
		Ref.	

From: John Kelly [mailto:jgkelly@csa.ie]
Sent: 30 May 2007 10:55
To: Sarah Gatley
Cc: tpaul@csa.ie
Subject: Irish Geological Heritage Enquiry, Maddoxtown, Co. Kilkenny

Dear Sarah,

I am currently preparing a Soils and Geology evaluation for an Environmental Impact Assessment for Maddoxtown Quarry, Bennetsbridge, Co. Kilkenny. The quarry is located at 255500E 152000N and is developed within dolomitised limestones of the Butlersgrove Formation.

Could you please let me know if there are any geological heritage issues arising from the current operation or planned development at this location.

Regards

Dr. John Kelly
Senior Geologist



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Windy Arbour, Dublin 14, Ireland.

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Website: www.jba.ie

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RE: Irish Geological Heritage Enquiry, Maddoxtown, Co. Kilkenny

Sarah Gatley [Sarah.Gatley@gsi.ie]

Dear John,

With reference to the EIS for Maddoxtown Quarry, just to note that this quarry is on our indicative list of geological heritage sites (Bennettsbridge Roadstone Dolomite Quarry: GR 256000 151000) as a very good example of dolomitised limestone (Butlersgrove Formation) in the Kilkenny area, under the IGH8 Lower Carboniferous Theme (or maybe, more appropriately under the IGH15 Economic Geology Theme). It is therefore recommended for County Geological Site (CGS) status.

However, there are no real management issues here from the IGH point of view. We have recently included the quarry in a County Heritage Report for Kilkenny (and it is listed in their County Development Plan), showing the NW face of the quarry for illustrative purposes. I note that there is a hill-top cairn on the northern side of the quarry, so quarrying will probably not extend much in that direction. In any case, IGH would only request that Roadstone notify us of any obviously new/different geological sections or features revealed through blasting and that a representative section of the geology is left at the end of the quarrying operation.

Is this just the EIS required under Section 261, or is there a proposed extension to the quarry? I assume that there will be an opportunity in the consultation process for IGH to ask Roadstone to consult with us regarding the end use of the quarry and the possibility of public access to a safe section, maybe even with some public information signage.

If you need any further information, please contact me.

Kind regards

Sarah

Dr Sarah Gatley
Senior Geologist, Head IGH Programme
Geological Survey of Ireland
Beggars Bush
Haddington Road
Dublin 4

Tel(Dir) +353-1/01 6782837

Fax: +353-1/01 6782559

Email: <<mailto:sarah.gatley@gsi.ie>>

Website: www.gsi.ie

Latest GSI Newsletter

http://www.gsi.ie/news/GSI_News/Issue_No_05/Web/Geology_matters_05.htm

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Borehole No

RP1

Sheet 1 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256059E - 150963N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 60.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				0		Overburden	
				1			
				2			
				3			
				4			
				5			
				6			
				7			
				8			
				9			

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Continued next sheet

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP1
 Sheet 2 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256059E - 150963N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 60.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 15/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				11			Overburden
13.80				13.80	46.20		Limestone with minor dolomite
	36	1	9	14			
15.00				15.00	45.00		Limestone with minor dolomite
	38	1	4	16			
18.00				18.00	42.00		Dolomitic Limestone
	37	1	11	19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP1
 Sheet 3 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256059E - 150963N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 60.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				-21.00	39.00		Dolomitic Limestone
				-22			Limestone with minor dolomite
	38	1	4	-23			
				-24.00	36.00		
				-25			
				-26			
				-27			
				-28			
				-29			

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End of Borehole at 24.00 m

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP2
 Sheet 1 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256135E - 151001N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 61.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				0			Overburden
				1			
				2			
				3			
				4			
5.00				55.00	56.00		Dolomitic Limestone
	31	3	23				
6.00				66.00	55.00		Dolomitic Limestone
				7			
	35	2	13				
				8			
9.00				99.00	52.00		Limestone with minor dolomite

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP2
 Sheet 2 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256135E - 151001N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 61.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 15/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
	38	0	4	11			Limestone with minor dolomite
12.00				12.00	49.00		Limestone with minor dolomite
	39	0	3	13			
				14			
15.00				15.00	46.00		Dolomitic Limestone
	36	3	19	16			
				17			
18.00				18.00	43.00		Limestone with minor dolomite
	39	1	5	19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

RP2

Sheet 3 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256135E - 151001N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 61.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 15/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				21.00	40.00	[Limestone pattern]	Limestone with minor dolomite
				22			Limestone with minor dolomite
	38	1	6	23			
				24.00	37.00		End of Borehole at 24.00 m
				25			
				26			
				27			
				28			
				29			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP3
 Sheet 1 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256208E - 151024N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 62.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 15/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				1			Overburden
				2			
				3			
				4			
5.00				55.00	57.00		Dolomitic Limestone
	37	2	13				
6.00				66.00	56.00		Limestone with minor dolomite
				7			
	38	1	4				
				8			
9.00				99.00	53.00		Limestone with minor dolomite

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP3
 Sheet 2 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256208E - 151024N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 62.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
12.00	38	1	5	11	50.00		Limestone with minor dolomite
	39	0	3	13			Limestone with minor dolomite
15.00	38	1	6	16	47.00		Limestone with minor dolomite
	39	1	5	19			Limestone with minor dolomite

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP3
 Sheet 3 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256208E - 151024N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 62.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				21.00	41.00	[Limestone pattern]	Limestone with minor dolomite
				22			Limestone with minor dolomite
	38	1	9	23		[Limestone pattern]	
				24.00	38.00		
				25			
				26			
				27			
				28			
				29			

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End of Borehole at 24.00 m

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP4
 Sheet 1 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256309E - 151061N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 67.50 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				0			Overburden
3.00				33.00	64.50		Dolomitic Limestone
	37	2	12				
6.00				66.00	61.50		Dolomitic Limestone
	35	2	12				
9.00				99.00	58.50		Limestone with minor dolomite

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP4
 Sheet 2 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256309E - 151061N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 67.50 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
12.00	37	1	5	11	55.50	[Brick pattern]	Limestone with minor dolomite
				12.00			Limestone with minor dolomite
15.00	39	0	3	13	52.50	[Brick pattern]	Limestone with minor dolomite
				14			Limestone with minor dolomite
18.00	38	1	8	15	49.50	[Brick pattern]	Limestone with minor dolomite
				16			Limestone with minor dolomite
	39	1	4	17		[Brick pattern]	
				18		[Brick pattern]	
				19		[Brick pattern]	

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP4
 Sheet 3 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256309E - 151061N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 67.50 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 15/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				21.00	46.50		Limestone with minor dolomite
				22			Limestone with minor dolomite
	38	1	5	23			
				24.00	43.50		
				25			
				26			
				27			
				28			
				29			

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End of Borehole at 24.00 m

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP5
 Sheet 1 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256215E - 151288N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 64.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				1			Overburden
3.00				33.00	61.00		Calcareous Dolomite
	23	10	80	4			
6.00				66.00	58.00		Calcareous Dolomite
	23	11	81	7			
9.00				99.00	55.00		Calcareous Dolomite

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

RP5

Sheet 2 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256215E - 151288N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 64.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
	24	11	86	11			Calcareous Dolomite
12.00				12.00	52.00		Limestone with minor dolomite
	38	1	5	13			
				14			
15.00				15.00	49.00		Limestone with minor dolomite
	38	1	7	16			
				17			
18.00				18.00	46.00		Limestone with minor dolomite
	38	1	6	19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP5
 Sheet 3 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256215E - 151288N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 64.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				41.00	43.00	[Brick pattern]	Limestone with minor dolomite
				22			Limestone with minor dolomite
	38	1	6	23			
				24.00	40.00		End of Borehole at 24.00 m
				25			
				26			
				27			
				28			
				29			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP6
 Sheet 1 of 3

Project Name: Maddoxtown RP 2004 Project No. 3588 Co-ords: 256102E - 151244N Hole Type RP

Location: Bennetsbridge, Co. Kilkenny Level: 65.00 m AOD Scale 1:50

Client: Roadstone Provinces Ltd Dates: 16/09/2004 Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
3.00				33.00	62.00	Overburden	
	22	13	96			Dolomite	
6.00				66.00	59.00	Dolomite	
	23	13	98			Dolomite	
9.00				99.00	56.00	Calcareous Dolomite	

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

RP6

Sheet 2 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256102E - 151244N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 65.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
	27	8	61	11			Calcareous Dolomite
12.00				12.00	53.00		Dolomitic Limestone
	35	2	16	13			
				14			
15.00				15.00	50.00		Limestone with minor dolomite
				16			
	38	1	5	17			
				18.00	47.00		Limestone with minor dolomite
				19			
	37	1	4				

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
RP6
 Sheet 3 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 256102E - 151244N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 65.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
21.00				21.00	44.00	[Brick pattern]	Limestone with minor dolomite
				22			Limestone with minor dolomite
	38	0	4	23		[Brick pattern]	
				24.00	41.00		
				25			
				26			
				27			
				28			
				29			

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End of Borehole at 24.00 m

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

RP7

Sheet 1 of 3

Project Name: Maddoxtown RP 2004

Project No.
3588

Co-ords: 255994E - 151191N

Hole Type
RP

Location: Bennetsbridge, Co. Kilkenny

Level: 64.00 m AOD

Scale
1:50

Client: Roadstone Provinces Ltd

Dates: 16/09/2004

Logged By
JGK

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
				1			Overburden
				2			
				3			
				4			
				5			
5.70	22	12	94	5.70	58.30		Dolomite
6.00				66.00	58.00		Dolomite
				7			Calcareous Dolomite
	22	12	93	8			
9.00				99.00	55.00		

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

RP7

Sheet 2 of 3

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 255994E - 151191N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 64.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

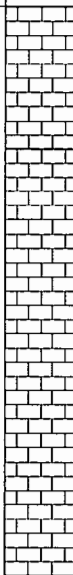
Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %				
	27	8	62	11		Diagonal hatching	Calcareous Dolomite
12.00				12.00	52.00	Diagonal hatching	Limestone with minor dolomite
	37	1	7	13		Brick pattern	
15.00				15.00	49.00	Diagonal hatching	Calcareous Dolomite
	24	10	79	16		Diagonal hatching	
18.00				18.00	46.00	Brick pattern	Limestone with minor dolomite
	37	1	6	19		Brick pattern	

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Remarks: See Figure 3.3.3 for borehole location.

Project Name: Maddoxtown RP 2004	Project No. 3588	Co-ords: 255994E - 151191N	Hole Type RP
Location: Bennetsbridge, Co. Kilkenny		Level: 64.00 m AOD	Scale 1:50
Client: Roadstone Provinces Ltd		Dates: 16/09/2004	Logged By JGK

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
	Ca%	Mg%	Dolomite %					
21.00					21.00	43.00		Limestone with minor dolomite
	36	1	4		22			Limestone with minor dolomite
					23			
					24.00	40.00		End of Borehole at 24.00 m
					25			
					26			
					27			
					28			
					29			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW7

Sheet 1 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 25104E - 151657N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 67.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								Sandy gravelly CLAY (BOULDER CLAY) sandy cobbly TILL
				1				
				2				
				3				
				4				
				4.50	62.50			DOLOMITE (WEATHERED ROCKHEAD) DOLOMITE
				5				
				6.00	61.00			DOLOMITE (BEDROCK) Dolomitic LIMESTONE
				7				
				8				
				9	57.90			LIMESTONE (LIMESTONE BEDROCK) LIMESTONE
				9.10				

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW7
 Sheet 2 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 25104E - 151657N	Hole Type RO
Location: Bennettsbridge, County Kilkenny	Level: 67.00 m AOD		Scale 1:50
Client: Roadstone Provinces	Dates: 23/05/2007		Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
					11		 LIMESTONE (LIMESTONE BEDROCK)	
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			

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Remarks: See Figure 3.3.3 for borehole location.



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GW7
 Sheet 3 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 25104E - 151657N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 67.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (LIMESTONE BEDROCK)
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			

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Remarks: See Figure 3.3.3 for borehole location.



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GW7
 Sheet 4 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 25104E - 151657N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 67.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (LIMESTONE BEDROCK)
					31			
					32			
					33			
					34			
					35			
					36			
					37			
					38			
					39			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW7

Sheet 5 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 25104E - 151657N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 67.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								LIMESTONE (LIMESTONE BEDROCK)
					41			
					42			
					43			
					44			
					45			
					46			
					47			
					48			
					48.80	18.20		
					49			
								End of Borehole at 48.80 m

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW8

Sheet 1 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255844E - 151410N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 66.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
Drill Tag			Dolomite %				
				0			Sandy gravelly CLAY (GLACIAL TILL) sandy cobbly TILL
				1			
				2			
				3			
				4			
				5			
				66.00	60.00		DOLOMITE (WEATHERED ROCKHEAD) weathered DOLOMITE
				7			
				8			
				99.00	57.00		DOLOMITE (BEDROCK) DOLOMITE

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW8

Sheet 2 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255844E - 151410N	Hole Type RO
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Location: Bennettsbridge, County Kilkenny	Level: 66.00 m AOD	Scale 1:50
---	--------------------	------------

Client: Roadstone Provinces	Dates: 23/05/2007	Logged By LB
-----------------------------	-------------------	--------------

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
					11			DOLOMITE (BEDROCK)
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			

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Remarks: See Figure 3.3.3 for borehole location.

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255844E - 151410N	Hole Type RO
---------------------------	---------------------	----------------------------	-----------------

Location: Bennettsbridge, County Kilkenny	Level: 66.00 m AOD	Scale 1:50
---	--------------------	---------------

Client: Roadstone Provinces	Dates: 23/05/2007	Logged By LB
-----------------------------	-------------------	-----------------

	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
	Drill Tag			Dolomite %				
21						DOLOMITE (BEDROCK)		
22								
23								
24								
25								
26								
27								
28								
29								

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW8
 Sheet 4 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255844E - 151410N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 66.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								DOLOMITE (BEDROCK)
					31			
					32			
					33			
					34			
					35			
					36			
					37			
					38			
					39			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW8
 Sheet 5 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255844E - 151410N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 66.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 23/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								DOLOMITE (BEDROCK)
					-41			
					-42			
					-43			
					-44			
					-45			
					-46			
					-47			
					-48			
					48.80	17.20		
					-49			End of Borehole at 48.80 m

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW9

Sheet 1 of 3

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255693E - 151196N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 52.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 22/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
					1			Sandy gravelly CLAY (GLACIAL TILL) sandy cobbly TILL
					2			
					3			
					4			
					4.90	47.10		DOLOMITE (BEDROCK) DOLOMITE
					5			
					6			
					7			
					8			
					9			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW9
 Sheet 2 of 3

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255693E - 151196N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 52.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 22/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
					11			DOLOMITE (BEDROCK)
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW9

Sheet 3 of 3

Project Name: Maddoxstown

Project No.
3713

Co-ords: 255693E - 151196N

Hole Type
RO

Location: Bennettsbridge, County Kilkenny

Level: 52.00 m AOD

Scale
1:50

Client: Roadstone Provinces

Dates: 22/05/2007

Logged By
LB

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description	
			Dolomite %					
				21		DOLOMITE (BEDROCK)		
				22				
				23				
				24				
				24.40	27.60			
				25				
				26				
				27				
				28				
				29				

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End of Borehole at 24.40 m

Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW10

Sheet 1 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255890E - 150860N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 58.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 25/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %				
				0			Sandy gravelly CLAY (GLACIAL TILL) sandy cobbly TILL
				1			
				2			
				3			
				4			
				5			
				6			
				7			
				7.30	50.70		DOLOMITE (BEDROCK) DOLOMITE
				8			
				9			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW10

Sheet 2 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255890E - 150860N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 58.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 25/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								DOLOMITE (BEDROCK)
				11				
				12				
				12.20	45.80			LIMESTONE (BEDROCK) LIMESTONE
				13				
				14				
				15				
				16				
				17				
				18				
				19				

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Remarks: See Figure 3.3.3 for borehole location.

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255890E - 150860N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 58.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 25/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (BEDROCK)
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW10

Sheet 4 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255890E - 150860N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 58.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 25/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								LIMESTONE (BEDROCK)
					31			
					32			
					33			
					34			
					35			
					36			
					36.60	21.40		
					37			DOLOMITE (BEDROCK) DOLOMITE
					38			
					39			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW10
 Sheet 5 of 5

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255890E - 150860N	Hole Type RO
Location: Bennettsbridge, County Kilkenny	Level: 58.00 m AOD		Scale 1:50
Client: Roadstone Provinces	Dates: 25/05/2007		Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								DOLOMITE (BEDROCK)
					41			
					42			
					42.70	15.30		End of Borehole at 42.70 m
					43			
					44			
					45			
					46			
					47			
					48			
					49			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW11

Sheet 2 of 8

Project Name: Maddoxstown	Project No. 3713	Co-ords: 256443E - 150933N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 71.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 24/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								LIMESTONE (BEDROCK)
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW11
 Sheet 3 of 8

Project Name: Maddoxstown	Project No. 3713	Co-ords: 256443E - 150933N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 71.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 24/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (BEDROCK)
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			

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Borehole No

GW11

Sheet 4 of 8

Project Name: Maddoxstown	Project No. 3713	Co-ords: 256443E - 150933N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 71.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 24/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (BEDROCK)
					-31			
					-32			
					-33			
					-34			
					-35			
					-36			
					-37			
					-38			
					-39			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW11
 Sheet 5 of 8

Project Name: Maddoxstown	Project No. 3713	Co-ords: 256443E - 150933N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 71.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 24/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								LIMESTONE (BEDROCK)
					-41			
					-42			
					-43			
					-44			
					-45			
					-46			
					-47			
					-48			
					-49			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No

GW11

Sheet 6 of 8

Project Name: Maddoxstown

Project No.
3713

Co-ords: 256443E - 150933N

Hole Type
RO

Location: Bennettsbridge, County Kilkenny

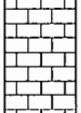
Level: 71.00 m AOD

Scale
1:50

Client: Roadstone Provinces

Dates: 24/05/2007

Logged By
LB

Drill Tag	Return Sample Analysis Data			Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %				
				51		 LIMESTONE (BEDROCK)	
				52			
				53			
				54			
				55			
				56			
				57			
				58			
				59			

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Borehole No
GW11
 Sheet 7 of 8

Project Name: Maddoxstown	Project No. 3713	Co-ords: 256443E - 150933N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 71.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 24/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (BEDROCK)
					-61			
					-62			
					-63			
					-64			
					-65			
					-66			
					-67			
					-68			
					-69			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW11
 Sheet 8 of 8

Project Name: Maddoxstown Project No. 3713 Co-ords: 256443E - 150933N Hole Type RO

Location: Bennettsbridge, County Kilkenny Level: 71.00 m AOD Scale 1:50

Client: Roadstone Provinces Dates: 24/05/2007 Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
			Dolomite %					
								LIMESTONE (BEDROCK)
					71			
					72			
					73			
					74			
					75			
					76			
					77			
					78			
					79			
					79.20	-8.20		End of Borehole at 79.20 m

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW12
 Sheet 1 of 3

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255905E - 150594N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 54.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 30/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Calcium %				
					1			Sandy gravelly CLAY (GLACIAL TILL) sandy cobbly TILL
					2			
					3			
					4			
					5			
					6			
					6.50	47.50		LIMESTONE (BEDROCK) LIMESTONE
					7			
					8			
					9			

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Borehole No

GW12

Sheet 2 of 3

Project Name: Maddoxstown	Project No. 3713	Co-ords: 255905E - 150594N	Hole Type RO
Location: Bennettsbridge, County Kilkenny		Level: 54.00 m AOD	Scale 1:50
Client: Roadstone Provinces		Dates: 30/05/2007	Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								LIMESTONE (BEDROCK)
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					18.30	35.70		DOLOMITE (BEDROCK) DOLOMITE
					19			

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Remarks: See Figure 3.3.3 for borehole location.



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Borehole No
GW12
 Sheet 3 of 3

Project Name: Maddoxstown Project No. 3713 Co-ords: 255905E - 150594N Hole Type RO

Location: Bennettsbridge, County Kilkenny Level: 54.00 m AOD Scale 1:50

Client: Roadstone Provinces Dates: 30/05/2007 Logged By LB

Drill Tag	Return Sample Analysis Data				Depth (m)	Level (m OD)	Litho	Stratum Description
				Dolomite %				
								DOLOMITE (BEDROCK)
					21			
					22			
					23			
					24			
					24.40	29.60		End of Borehole at 24.40 m
					25			
					26			
					27			
					28			
					29			

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Remarks: See Figure 3.3.3 for borehole location.

Borehole	From (m)	To (m)	Mg%	Dolomite %	Lithology
RP-01	0.00	13.80	0.00	0	Overburden
RP-01	13.80	15.00	1.17	9	Limestone
RP-01	15.00	18.00	0.54	4	Limestone
RP-01	18.00	21.00	1.45	11	Dolomitic Limestone
RP-01	21.00	24.00	0.56	4	Limestone
RP-02	0.00	5.00	0.00	0	Overburden
RP-02	5.00	6.00	3.07	23	Dolomitic Limestone
RP-02	6.00	9.00	1.69	13	Dolomitic Limestone
RP-02	9.00	12.00	0.48	4	Limestone
RP-02	12.00	15.00	0.35	3	Limestone
RP-02	15.00	18.00	2.56	19	Dolomitic Limestone
RP-02	18.00	21.00	0.70	5	Limestone
RP-02	21.00	24.00	0.80	6	Limestone
RP-03	0.00	5.00	0.00	0	Overburden
RP-03	5.00	6.00	1.70	13	Dolomitic Limestone
RP-03	6.00	9.00	0.52	4	Limestone
RP-03	9.00	12.00	0.62	5	Limestone
RP-03	12.00	15.00	0.45	3	Limestone
RP-03	15.00	18.00	0.85	6	Limestone
RP-03	18.00	21.00	0.65	5	Limestone
RP-03	21.00	24.00	1.20	9	Limestone
RP-04	0.00	3.00	0.00	0	Overburden
RP-04	3.00	6.00	1.64	12	Dolomitic Limestone
RP-04	6.00	9.00	1.57	12	Dolomitic Limestone
RP-04	9.00	12.00	0.63	5	Limestone
RP-04	12.00	15.00	0.42	3	Limestone
RP-04	15.00	18.00	0.99	8	Limestone
RP-04	18.00	21.00	0.56	4	Limestone
RP-04	21.00	24.00	0.70	5	Limestone
RP-05	0.00	3.00	0.00	0	Overburden
RP-05	3.00	6.00	10.49	80	Calcareous Dolomite
RP-05	6.00	9.00	10.68	81	Calcareous Dolomite
RP-05	9.00	12.00	11.40	86	Calcareous Dolomite
RP-05	12.00	15.00	0.60	5	Limestone
RP-05	15.00	18.00	0.89	7	Limestone
RP-05	18.00	21.00	0.75	6	Limestone
RP-05	21.00	24.00	0.75	6	Limestone
RP-06	0.00	3.00	0.00	0	Overburden
RP-06	3.00	6.00	12.68	96	Dolomite
RP-06	6.00	9.00	12.88	98	Dolomite
RP-06	9.00	12.00	8.04	61	Calcareous Dolomite
RP-06	12.00	15.00	2.08	16	Dolomitic Limestone
RP-06	15.00	18.00	0.62	5	Limestone
RP-06	18.00	21.00	0.52	4	Limestone
RP-06	21.00	24.00	0.49	4	Limestone
RP-07	0.00	5.70	0.00	0	Overburden
RP-07	5.70	6.00	12.42	94	Dolomite
RP-07	6.00	9.00	12.22	99	Dolomite
RP-07	9.00	12.00	8.94	62	Calcareous Dolomite
RP-07	12.00	15.00	0.90	7	Limestone
RP-07	15.00	18.00	10.46	79	Calcareous Dolomite
RP-07	18.00	21.00	0.76	6	Limestone
RP-07	21.00	24.00	0.56	4	Limestone
Q101	0.00	3.05	12.62	98	Dolomite
Q101	0.00	3.05	12.62	98	Dolomite
Q101	3.05	6.10	12.22	96	Dolomite
Q101	3.05	6.10	12.22	96	Dolomite
Q101	6.10	9.14	12.53	96	Dolomite
Q101	6.10	9.14	12.53	96	Dolomite
Q101	9.14	12.19	12.86	98	Dolomite
Q101	9.14	12.19	12.86	98	Dolomite
Q101	12.19	15.24	12.82	98	Dolomite
Q101	12.19	15.24	12.82	98	Dolomite
Q101	15.24	18.29	12.87	98	Dolomite
Q101	15.24	18.29	12.87	98	Dolomite
Q101	18.29	21.33	12.42	96	Dolomite
Q101	18.29	21.33	12.42	96	Dolomite
Q101	21.33	24.38	12.76	97	Dolomite
Q101	21.33	24.38	12.76	97	Dolomite
Q101	24.38	27.43	12.60	97	Dolomite
Q101	24.38	27.43	12.60	97	Dolomite
Q101	27.43	30.48	12.75	98	Dolomite
Q101	27.43	30.48	12.75	98	Dolomite
Q102	0.00	3.05	12.72	98	Dolomite
Q102	0.00	3.05	12.72	98	Dolomite
Q102	3.05	6.10	12.69	98	Dolomite
Q102	3.05	6.10	12.69	98	Dolomite
Q102	6.10	9.14	12.67	98	Dolomite
Q102	6.10	9.14	12.67	98	Dolomite
Q102	9.14	12.19	12.73	98	Dolomite
Q102	9.14	12.19	12.73	98	Dolomite
Q102	12.19	15.24	12.90	99	Dolomite
Q102	12.19	15.24	12.90	99	Dolomite
Q102	15.24	18.29	12.79	98	Dolomite
Q102	15.24	18.29	12.79	98	Dolomite
Q103	0.00	3.05	12.46	95	Dolomite
Q103	0.00	3.05	12.46	95	Dolomite
Q103	3.05	4.88	12.28	94	Dolomite
Q103	3.05	4.88	12.28	94	Dolomite
Q104	0.00	0.76	12.60	98	Dolomite
Q104	0.00	0.76	12.60	98	Dolomite
Q104	0.76	6.10	12.71	98	Dolomite
Q104	0.76	6.10	12.71	98	Dolomite

Borehole	From (m)	To (m)	Mg%	Dolomite %	Lithology
Q104	6.10	8.23	12.71	97	Dolomite
Q104	6.10	8.23	12.71	97	Dolomite
Q104	8.23	12.19	12.43	97	Dolomite
Q104	8.23	12.19	12.43	97	Dolomite
Q104	12.19	15.24	12.06	96	Dolomite
Q104	12.19	15.24	12.06	96	Dolomite
Q104	15.24	18.29	12.62	97	Dolomite
Q104	15.24	18.29	12.62	97	Dolomite
Q104	18.29	21.03	12.16	95	Dolomite
Q104	18.29	21.03	12.16	95	Dolomite
Q104	21.03	24.38	12.41	95	Dolomite
Q104	21.03	24.38	12.41	95	Dolomite
Q104	24.38	27.43	12.00	93	Dolomite
Q104	24.38	27.43	12.00	93	Dolomite
Q104	27.43	30.17	11.94	94	Dolomite
Q104	27.43	30.17	11.94	94	Dolomite
Q104	30.17	32.61	12.06	93	Dolomite
Q104	30.17	32.61	12.06	93	Dolomite
Q105	0.00	3.05	12.59	97	Dolomite
Q105	0.00	3.05	12.59	97	Dolomite
Q105	3.05	6.10	12.78	98	Dolomite
Q105	3.05	6.10	12.78	98	Dolomite
Q105	6.10	9.14	12.59	98	Dolomite
Q105	6.10	9.14	12.59	98	Dolomite
Q105	9.14	12.19	12.79	99	Dolomite
Q105	9.14	12.19	12.79	99	Dolomite
Q105	12.19	15.24	12.54	98	Dolomite
Q105	12.19	15.24	12.54	98	Dolomite
Q105	15.24	18.29	12.67	100	Dolomite
Q105	15.24	18.29	12.67	100	Dolomite
Q105	18.29	21.33	12.77	101	Dolomite
Q105	18.29	21.33	12.77	101	Dolomite
Q105	21.33	24.38	12.71	99	Dolomite
Q105	21.33	24.38	12.71	99	Dolomite
Q105	24.38	27.43	12.52	99	Dolomite
Q105	24.38	27.43	12.52	99	Dolomite
Q105	27.43	30.48	12.50	99	Dolomite
Q105	27.43	30.48	12.50	99	Dolomite
Q105	30.48	34.14	12.59	100	Dolomite
Q105	30.48	34.14	12.59	100	Dolomite
Q105	34.14	36.88	12.26	98	Dolomite
Q105	34.14	36.88	12.26	98	Dolomite
Q106	0.00	3.05	12.60	101	Dolomite
Q106	0.00	3.05	12.60	101	Dolomite
Q106	3.05	6.10	12.33	98	Dolomite
Q106	3.05	6.10	12.33	98	Dolomite
Q106	6.10	9.14	12.62	98	Dolomite
Q106	6.10	9.14	12.62	98	Dolomite
Q106	9.14	12.19	12.74	97	Dolomite
Q106	9.14	12.19	12.74	97	Dolomite
Q106	12.19	15.24	12.68	99	Dolomite
Q106	12.19	15.24	12.68	99	Dolomite
Q106	15.24	17.37	13.26	101	Dolomite
Q106	15.24	17.37	13.26	101	Dolomite
Q107	0.00	3.05	12.79	98	Dolomite
Q107	0.00	3.05	12.79	98	Dolomite
Q107	3.05	6.10	13.00	99	Dolomite
Q107	3.05	6.10	13.00	99	Dolomite
Q107	6.10	8.47	12.35	97	Dolomite
Q107	6.10	8.47	12.35	97	Dolomite
Q107	8.47	12.19	12.99	99	Dolomite
Q107	8.47	12.19	12.99	99	Dolomite
Q107	12.19	15.24	12.51	97	Dolomite
Q107	12.19	15.24	12.51	97	Dolomite
Q107	15.24	19.66	12.27	96	Dolomite
Q107	15.24	19.66	12.27	96	Dolomite
Q107	19.66	22.40	12.16	97	Dolomite
Q107	19.66	22.40	12.16	97	Dolomite
Q107	22.40	24.38	12.33	97	Dolomite
Q107	22.40	24.38	12.33	97	Dolomite
Q107	24.38	27.43	12.45	97	Dolomite
Q107	24.38	27.43	12.45	97	Dolomite
Q107	27.43	30.48	12.49	97	Dolomite
Q107	27.43	30.48	12.49	97	Dolomite
Q107	30.48	33.53	12.37	97	Dolomite
Q107	30.48	33.53	12.37	97	Dolomite
Q107	33.53	36.57	12.49	97	Dolomite
Q107	33.53	36.57	12.49	97	Dolomite
Q107	36.57	39.62	12.43	97	Dolomite
Q107	36.57	39.62	12.43	97	Dolomite
Q107	39.62	42.97	12.42	97	Dolomite
Q107	39.62	42.97	12.42	97	Dolomite
Q107	42.97	46.48	12.35	98	Dolomite
Q107	42.97	46.48	12.35	98	Dolomite
Q108	0.00	3.05	12.60	97	Dolomite
Q108	0.00	3.05	12.60	97	Dolomite
Q108	3.05	6.10	12.72	98	Dolomite
Q108	3.05	6.10	12.72	98	Dolomite
Q108	6.10	9.14	12.62	97	Dolomite
Q108	6.10	9.14	12.62	97	Dolomite
Q108	9.14	12.19	12.63	97	Dolomite
Q108	9.14	12.19	12.63	97	Dolomite
Q108	12.19	15.24	12.71	98	Dolomite

Borehole	From (m)	To (m)	Mg%	Dolomite %	Lithology
Q108	12.19	15.24	12.71	98	Dolomite
Q108	15.24	18.29	12.55	98	Dolomite
Q108	15.24	18.29	12.55	98	Dolomite
Q108	18.29	21.33	12.67	98	Dolomite
Q108	18.29	21.33	12.67	98	Dolomite
Q108	21.33	24.38	11.88	97	Dolomite
Q108	21.33	24.38	11.88	97	Dolomite
Q108	24.38	27.43	12.26	96	Dolomite
Q108	24.38	27.43	12.26	96	Dolomite
Q108	27.43	29.26	12.45	97	Dolomite
Q108	27.43	29.26	12.45	97	Dolomite
Q109	0.00	1.52	7.61	62	Calcareous Dolomite
Q109	0.00	1.52	7.61	62	Calcareous Dolomite
Q109	1.52	3.51	12.51	97	Dolomite
Q109	1.52	3.51	12.51	97	Dolomite
Q109	3.51	6.55	12.54	98	Dolomite
Q109	3.51	6.55	12.54	98	Dolomite
Q109	6.55	9.60	12.63	98	Dolomite
Q109	6.55	9.60	12.63	98	Dolomite
Q109	9.60	11.12	12.60	98	Dolomite
Q109	9.60	11.12	12.60	98	Dolomite
Q109	11.12	12.65	12.58	97	Dolomite
Q109	11.12	12.65	12.58	97	Dolomite
Q109	12.65	15.70	12.53	97	Dolomite
Q109	12.65	15.70	12.53	97	Dolomite
Q109	15.70	18.74	12.41	97	Dolomite
Q109	15.70	18.74	12.41	97	Dolomite
Q109	18.74	21.79	12.39	97	Dolomite
Q109	18.74	21.79	12.39	97	Dolomite
Q109	21.79	24.69	9.00	73	Calcareous Dolomite
Q109	21.79	24.69	9.00	73	Calcareous Dolomite
Q109	24.69	26.67	5.20	40	Dolomitic Limestone
Q109	24.69	26.67	5.20	40	Dolomitic Limestone
Q116	0.00	2.13	13.15	99	Dolomite
Q116	2.13	5.18	14.66	105	Dolomite
Q116	5.18	8.23	12.30	96	Dolomite
Q116	8.23	11.28	12.54	95	Dolomite
Q116	11.28	14.32	11.88	101	Dolomite
Q116	14.32	17.37	13.03	96	Dolomite
Q116	17.37	20.42	12.60	97	Dolomite
Q116	20.42	23.47	12.97	101	Dolomite
Q116	23.47	26.52	13.63	102	Dolomite
Q116	26.52	29.56	11.76	102	Dolomite
Q116	29.56	32.61	12.30	94	Dolomite
Q116	32.61	35.05	12.30	101	Dolomite
Q117	0.00	3.20	12.34	98	Dolomite
Q117	3.20	6.25	12.64	98	Dolomite
Q117	6.25	9.30	12.67	99	Dolomite
Q117	9.30	12.34	12.18	97	Dolomite
Q117	12.34	15.39	11.78	96	Dolomite
Q117	15.39	18.44	13.69	101	Dolomite
Q117	18.44	21.49	12.30	98	Dolomite
Q117	21.49	24.54	12.36	98	Dolomite
Q117	24.54	27.58	12.67	99	Dolomite
Q117	27.58	30.63	12.36	99	Dolomite
Q117	30.63	33.37	12.42	99	Dolomite
Q118	0.00	3.05	12.54	98	Dolomite
Q118	3.05	6.10	10.98	88	Calcareous Dolomite
Q118	6.10	9.14	11.76	96	Dolomite
Q118	9.14	12.19	12.42	95	Dolomite
Q118	12.19	15.24	11.46	92	Dolomite
Q118	15.24	18.29	10.98	94	Dolomite
Q118	18.29	21.33	13.69	101	Dolomite
Q118	21.33	24.38	11.88	95	Dolomite
Q118	24.38	27.43	13.63	99	Dolomite
Q118	27.43	30.48	11.94	110	Dolomite
Q118	30.48	33.53	12.12	95	Dolomite
Q118	33.53	36.57	12.24	95	Dolomite
Q118	36.57	39.32	12.18	96	Dolomite
Q118	39.32	42.67	11.16	92	Dolomite
Q118	42.67	45.72	12.48	97	Dolomite
Q118	45.72	48.77	12.30	99	Dolomite
Q118	48.77	51.81	14.29	112	Dolomite
Q118	51.81	54.86	10.98	93	Dolomite
Q118	54.86	57.91	12.60	101	Dolomite
Q118	57.91	60.96	11.55	96	Dolomite
Q118	60.96	64.00	13.27	103	Dolomite
Q118	64.00	67.05	13.03	101	Dolomite
Q118	67.05	70.10	8.99	84	Calcareous Dolomite
Q118	70.10	73.15	10.75	92	Dolomite
Q118	73.15	76.20	10.92	93	Dolomite
Q118	76.20	79.24	13.15	102	Dolomite
Q118	79.24	82.29	11.58	95	Dolomite
Q118	82.29	85.34	10.61	88	Calcareous Dolomite
Q118	85.34	88.39	11.01	89	Calcareous Dolomite
Q118	88.39	91.44	12.67	100	Dolomite
Q118	91.44	94.48	11.22	94	Dolomite
Q118	94.48	97.53	11.76	95	Dolomite
Q118	97.53	100.58	11.76	90	Calcareous Dolomite
Q118	100.58	103.63	11.64	103	Dolomite
Q118	103.63	106.67	10.55	92	Dolomite
Q118	106.67	109.72	10.74	93	Dolomite
Q118	109.72	112.77	11.43	95	Dolomite

Borehole	From (m)	To (m)	Mg%	Dolomite %	Lithology
Q118	112.77	115.82	7.03	59	Calcareous Dolomite
Q118	115.82	118.87	1.41	11	Dolomitic Limestone
Q118	118.87	121.91	5.71	44	Dolomitic Limestone
Q118	121.91	124.96	3.56	29	Dolomitic Limestone
Q118	124.96	126.49	10.80	90	Dolomite
Q119	0.00	2.44	12.79	106	Dolomite
Q119	2.44	5.49	12.06	105	Dolomite
Q119	5.49	8.53	12.67	108	Dolomite
Q119	8.53	11.58	13.15	111	Dolomite
Q119	11.58	14.63	13.51	104	Dolomite
Q119	14.63	17.68	13.69	105	Dolomite
Q119	17.68	20.73	13.87	107	Dolomite
Q119	20.73	23.77	13.75	107	Dolomite
Q119	23.77	26.82	13.27	100	Dolomite
Q119	26.82	29.87	13.87	105	Dolomite
Q119	29.87	32.92	13.51	107	Dolomite
Q119	32.92	35.66	13.51	106	Dolomite
Q120	0.00	2.13	13.42	98	Dolomite
Q120	2.13	5.18	12.51	99	Dolomite
Q120	5.18	8.23	12.48	97	Dolomite
Q120	8.23	11.28	12.97	101	Dolomite
Q120	11.28	14.32	12.82	98	Dolomite
Q120	14.32	17.37	12.82	103	Dolomite
Q120	17.37	20.42	12.67	99	Dolomite
Q120	20.42	23.47	12.67	97	Dolomite
Q120	23.47	26.52	12.21	97	Dolomite
Q120	26.52	29.56	12.97	96	Dolomite
Q120	29.56	32.61	12.21	104	Dolomite
Q120	32.61	35.36	13.27	101	Dolomite
Q121	0.00	2.74	13.69	100	Dolomite
Q121	2.74	5.79	12.60	98	Dolomite
Q121	5.79	8.84	13.39	100	Dolomite
Q121	8.84	11.89	13.33	98	Dolomite
Q121	11.89	14.93	12.60	96	Dolomite
Q121	14.93	17.98	12.67	96	Dolomite
Q121	17.98	21.03	12.67	94	Dolomite
Q121	21.03	24.08	12.54	98	Dolomite
Q121	24.08	27.13	12.36	96	Dolomite
Q121	27.13	30.17	12.48	95	Dolomite
Q121	30.17	33.22	12.60	96	Dolomite
Q121	33.22	35.90	12.60	98	Dolomite
Q122	0.00	1.52	12.60	99	Dolomite
Q122	1.52	4.57	12.97	98	Dolomite
Q122	4.57	7.62	13.57	100	Dolomite
Q122	7.62	10.67	13.42	97	Dolomite
Q122	10.67	13.72	13.87	100	Dolomite
Q122	13.72	16.76	13.57	100	Dolomite
Q122	16.76	19.81	12.97	99	Dolomite
Q122	19.81	22.86	13.57	98	Dolomite
Q122	22.86	25.91	12.67	96	Dolomite
Q122	25.91	28.95	12.51	99	Dolomite
Q122	28.95	29.38	12.85	99	Dolomite
Q123	0.00	1.52	12.79	98	Dolomite
Q123	1.52	4.57	12.67	97	Dolomite
Q123	4.57	7.62	12.51	95	Dolomite
Q123	7.62	10.67	13.12	96	Dolomite
Q123	10.67	13.72	12.97	97	Dolomite
Q123	13.72	16.76	12.97	96	Dolomite
Q123	16.76	19.81	12.60	96	Dolomite
Q123	19.81	22.86	13.27	97	Dolomite
Q123	22.86	25.91	13.27	97	Dolomite
Q123	25.91	28.95	12.67	96	Dolomite
Q123	28.95	32.00	13.09	96	Dolomite
Q123	32.00	34.44	12.48	98	Dolomite
GW07	3.05	6.10	11.71	88.84	Dolomite
GW07	6.10	9.14	1.65	12.49	Dolomitic Limestone
GW07	9.14	12.19	0.4	3.01	Limestone
GW07	12.19	15.24	0.43	3.24	Limestone
GW07	15.24	18.29	0.79	5.99	Limestone
GW07	18.29	21.34	0.54	4.1	Limestone
GW07	21.34	24.38	1.01	7.66	Limestone
GW07	24.38	27.43	0.44	3.31	Limestone
GW07	27.43	30.48	0.51	3.85	Limestone
GW07	30.48	33.53	0.96	7.25	Limestone
GW07	33.53	36.58	0.68	5.15	Limestone
GW07	36.58	39.62	0.54	4.07	Limestone
GW07	39.62	42.67	0.49	3.75	Limestone
GW07	42.67	45.72	0.45	3.44	Limestone
GW07	45.72	48.77	0.47	3.55	Limestone
GW08	6.10	9.14	13.16	99.88	Dolomite
GW08	9.14	12.19	13.33	101.16	Dolomite
GW08	12.19	15.24	13	98.6	Dolomite
GW08	15.24	18.29	13.11	99.49	Dolomite
GW08	18.29	21.34	13.08	99.21	Dolomite
GW08	21.34	24.38	13.47	102.2	Dolomite
GW08	24.38	27.43	13.07	99.19	Dolomite
GW08	27.43	30.48	12.81	97.16	Dolomite
GW08	30.48	33.53	12.68	96.2	Dolomite
GW08	33.53	36.58	13	98.61	Dolomite
GW08	36.58	39.62	12.94	98.17	Dolomite
GW08	39.62	42.67	12.93	98.1	Dolomite
GW08	42.67	45.72	13.2	100.11	Dolomite
GW08	45.72	48.77	12.93	98.07	Dolomite

Borehole	From (m)	To (m)	Mg%	Dolomite %	Lithology
GW09	6.10	9.14	12.92	98	Dolomite
GW09	9.14	12.19	12.55	95.19	Dolomite
GW09	12.19	15.24	12.54	95.12	Dolomite
GW09	15.24	18.29	12.05	91.41	Dolomite
GW09	18.29	21.34	12.7	96.39	Dolomite
GW09	21.34	24.38	12.55	95.24	Dolomite
GW10	6.10	9.14	11.54	87.58	Calcareous Dolomite
GW10	9.14	12.19	10.42	79.04	Calcareous Dolomite
GW10	12.19	15.24	1.62	12.32	Dolomitic Limestone
GW10	15.24	18.29	0.86	6.5	Limestone
GW10	18.29	21.34	0.52	3.95	Limestone
GW10	21.34	24.38	0.58	4.4	Limestone
GW10	24.38	27.43	1.89	14.32	Dolomitic Limestone
GW10	27.43	30.48	0.65	4.94	Limestone
GW10	30.48	33.53	1.44	10.93	Dolomitic Limestone
GW10	33.53	36.58	1.73	13.11	Dolomitic Limestone
GW10	36.58	39.62	11.95	90.64	Dolomite
GW10	39.62	42.67	11.81	89.62	Dolomite
GW11	3.05	6.10	0.44	3.36	Limestone
GW11	6.10	9.14	0.72	5.43	Limestone
GW11	9.14	12.19	0.56	4.26	Limestone
GW11	12.19	15.24	0.44	3.33	Limestone
GW11	15.24	18.29	1.24	9.37	Dolomitic Limestone
GW11	18.29	21.34	1	7.55	Limestone
GW11	21.34	24.38	0.75	5.66	Limestone
GW11	24.38	27.43	1.49	11.31	Dolomitic Limestone
GW11	27.43	30.48	0.55	4.16	Limestone
GW11	30.48	33.53	0.53	4.02	Limestone
GW11	33.53	36.58	0.44	3.37	Limestone
GW11	36.58	39.62	0.44	3.35	Limestone
GW11	39.62	42.67	0.6	4.55	Limestone
GW11	42.67	45.72	2.93	22.23	Dolomitic Limestone
GW11	45.72	48.77	0.71	5.41	Limestone
GW11	48.77	51.82	1.53	11.6	Dolomitic Limestone
GW11	51.82	54.86	0.5	3.78	Limestone
GW11	54.86	57.91	0.46	3.46	Limestone
GW11	57.91	60.96	0.68	5.13	Limestone
GW11	60.96	64.01	0.47	3.53	Limestone
GW11	64.01	67.06	0.6	4.53	Limestone
GW11	67.06	70.10	1.07	8.13	Limestone
GW11	70.10	73.15	2.42	18.39	Dolomitic Limestone
GW11	73.15	76.20	0.9	6.84	Limestone
GW11	76.20	79.25	1.71	12.98	Dolomitic Limestone
GW12	6.10	9.14	0.56	4.24	Limestone
GW12	9.14	12.19	1.04	7.87	Limestone
GW12	12.19	15.24	0.51	3.85	Limestone
GW12	15.24	18.29	0.44	3.36	Limestone
GW12	18.29	21.34	10.43	79.14	Calcareous Dolomite
GW12	21.34	24.38	1.9	90.3	Dolomite

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