June 2025

PATRICK McCAFFREY & SONS LTD

Remedial Environmental Impact Assessment Report – Volume 3 Appendices

Substitute Consent Application

Patrick McCaffrey & Sons Ltd

Ballymagroarty Quarries, Ballintra, Co. Donegal, Ireland

MALONE O'REGAN ENVIRONMENTAL

MALONE O'REGAN

Remedial Environmental Impact Assessment Report – Volume 3

Substitute Consent Application

Patrick McCaffrey & Sons Ltd

Ballymagroarty Quarries, Ballintra, Co. Donegal, Ireland

APPENDICES

Appendix 2-1: Inspector's Report 2016

Appendix 2-2: LWAT 41 January 2016

Appendix 2-3: LWAT 48 January 2016

Appendix 2-4: Air Emissions Licence

Appendix 3-1: Environmental Management System

Appendix 6-1: OSI_6inch and 25inch Legend

Appendix 6-2: Japanese Knotwood Technical Note

Appendix 7-1: MM250709-10 South Quarry

Appendix 7-2: MM250709-04 North Quarry

Appendix 8-1: McCaffrey's Quarry Hydrology & Hydrogeology

Appendix 8-2: CLS Lab Results

Appendix 8-3: BHP Reports

Appendix 8-4: SW Reports

Appendix 8-5: Discharge Volume Rates

Appendix 9-1: Air Dispersion Model

Appendix 9-2: Mineral Dust Risk Assessment

Appendix 9-3: Bergerhoff Method Results

Appendix 9-4: Ballymagroarty Technical Note

Appendix 9-5: Asphalt Plant Monitoring Results

Appendix 11-1: Acoustic Glossary of Terms

Appendix 11-2-1: Historic Sources and Receivers

Appendix 11-2-2: Currently Sources and Receivers

Appendix 11-2-3: Currently Results

Appendix 11-2-4: Historic Results

Appendix 11-2-5: Historic Lday

Appendix 11-2-6: Currently Lday

Appendix 11-3-1: Met Éireann 241114

Appendix 11-3-2: Met Éireann 241115

Appendix 11-4: Noise Plates and Charts

Appendix 13-1: Recorded Monuments in the Study Area

Appendix 13-2: Sites and Monuments Record in the Study Area

Appendix 14-1: Traffic Counts

Appendix 14-2: Traffic Flow Sheets

Appendix 14-3: PICADY Results

APPENDICES

Appendix 2

APPENDIX 2-1

An Bord Pleanála

Inspector's Report SU05D.SU0128.

Development	Substitute Consent Application for a Quarry.
Location	Ballymagroarty and Glasbolie, Ballintra, County Donegal.
Planning Authority	Donegal County Council.
Planning Authority Reg. Ref.	---
Applicant	Patrick McCaffrey and Sons.
Type of Application	Application for Substitute Consent.
Observers	James Gorman Pierce O' Gorman Dorasami Raman Christine Dinsmore Stewart Kirkpatrick Hugh Gorman Mary Cosgrove Geological Survey of Ireland Irish Water Jason Cohen

Date of Site Inspection	8th November, 2016.
Inspector	Paul Caprani.

1.0 INTRODUCTION

1.1. The previous planning report prepared by myself, Paul Caprani Senior Planning Inspector, dated 22nd May, 2015 (Reg. Ref. SU 0128) details the background to the operations on site, describing the site location and description together with the existing operations on site and the report also summarised the various submissions and responses contained on file. Finally report sets out the planning policy context prior to undertaking a preliminary assessment of the substitute consent application. My previous report of May, 2015 should be read in conjunction with the supplementary report now prepared for the Board.

1.2. My preliminary assessment concluded that the Board should issue a Direction specifically stating what geographical area of the quarry should be included in any application for substitute consent. The requirement for the revised Direction from the Board was predicated on the various disputes and claims contained on file as well as a level of ambiguity in the various decisions made regarding the geographical area of the quarry which should form the basis of the substitute consent application.

1.3. In its direction the Board requested the applicant to prepare and submit a revised remedial EIS and revised remedial NIS in relation to the overall quarry development of a subject site (north quarry, south quarry and the quarried lands to the east of the public road). This Direction was dated 19th June, 2015.

1.4. In a further letter on behalf of the applicant dated 21st July, 2015 the rationale behind the Board direction was questioned on the basis that it was previously decided that only the area to the north of the main quarry would be included for the purposes of the substitute consent application. It is suggested that the Board does not have jurisdiction to request an enlarged and substantially different area as part of the further information. Without prejudice to the above the applicant also requested an extension of time within which to submit a revised application.

1.5. On 11th August, 2015 the applicant was advised of recent legislation signed into law whereby it was now open to the applicant under the provisions of section 37L(7) to inform the Board whether or not it was the applicant's intention to submit a concurrent application for an extension to the quarry under the provisions of section 37L.

1.6. A further Direction from the Board and dated 16th September, 2015 determined that the applicant should be afforded a three-month extension of time to submit the information requested (namely the revised remedial EIS and revised remedial NIS) under the original Section 132 notice.

1.7. A letter dated 2nd September, 2015 on behalf of the applicant states that the applicant hereby gives notice under the provisions of section 37(L)(b) that they intend to submit a simultaneous application for further development of lands at the subject site. (See quarry file QD05 QD0018 which should be assessed in conjunction with the current application for substitute consent).

2.0 Submission of Revised Remedial Environmental Impact Statement and Revised Remedial Natura Impact Statement

On 15th December, 2015 the applicant submitted a revised rEIS and revised rNIS which provides an assessment of the overall quarry development which includes an assessment of the in combination effects of the north quarry and the main quarry to the south as well as the quarry land to the east of the public road as requested by the Board.

3.0 Further Submissions by Observers in response to revised rEIS and rNIS submitted.

3.1. Submission from Mary Cosgrove

3.1.1. It reiterates that the quality of lives of the residents living in the area around the quarry have been totally destroyed with their properties completely devalued and the land being destroyed as a result of dust, smoke and noise. The proposal has adversely impacted on the applicant's amenity and health and has visually destroyed a scenic area. It is suggested that the Departments of Justice, Environment and Social Protection should be alerted as to this information. It is inconceivable that the

applicant would be granted planning permission to continue this process for another 35 years.

3.2. **Submission from the Geological Survey of Ireland**

.2.1. A report from the GSI makes reference to Chapter 5.3.8 of the rEIS in respect of geological heritage. It is suggested that the list presented in Table 5.4 is incomplete in that a karst feature, which provides an excellent example of a shallow developed roof cave, located approximately 3.7 kilometres from the site and this feature has not been included in the documentation submitted.

3.3. **Submission from Irish Water**

.3.1. A letter from Irish Water has reviewed the information on file and notes that the quarry activities have ceased and reinstatement works are proposed. It is noted that water supply sources for the Ballymagroarty Water Treatment Plant and the Cashelard Water Treatment Plant are located in proximity to the quarry. There is also a public watermain located approximately 200 metres to the west of the quarry. Any reinstatement works should take account of Irish Water's assets and ensure protection of same.

3.4. **Submission from Hugh Gorman**

.4.1. It states that the existing quarry has a huge and continuing negative impact on the observer's life. The observer's property is in a direct line of the site. The dwelling is frequently in the direct line of dust, noise and smells emanating from the south quarry. As a result the observer states that he cannot reside in the house. The south quarry is at the heart of the operations and this is where the majority of the pollutants arise.

3.5. **Submission from Mr. Jason Cohen**

.5.1. Again concerns are expressed in relation to levels of dust, noise and vibration associated with the existing quarry and any increase in the quarry will accentuate this dramatically. It is acknowledged that the quarry was in operation when the

observer bought his house but it was not envisaged that the quarry would be expanding. The existing quarry has resulted in houses being unsellable in the area.

3.6. **Submission from Donegal County Council**

3.6.1. It states that the contents of the revised rEIS is noted and in particular the additional remedial measures proposed in respect of:

- Hydrology and hydrogeology.
- Landscape and Restoration.
- Archaeology and Cultural Heritage.

3.6.2. It is stated with the continued implementation of existing mitigation measures it is noted that the Planning Authority has no objection in principle to An Bord Pleanála approving the current application for substitute consent subject to conditions and the implementation of existing mitigation measures as set out in the revised remedial Environmental Impact Statement.

3.7. **Submission from Pierce O'Gorman**

3.7.1. The submission argues that the proposal does not accord with the Board Direction. It is argued that a new application was not submitted, as required under the Board's Direction dated 29th June, 2015. An Bord Pleanála should therefor invalidate the application. The documentation submitted does not give a fair realistic assessment of the impact of the quarry on surrounding townlands.

3.7.2. As part of the restoration plan it was proposed to incorporate benches in the northern quarry after excavation ceased. It is clear however according to the observer from the photographs attached, that no such benches were incorporated and the quarry comprises of a sheer cliff face. This has resulted in extremely dangerous excavation. It is also contended that the applicants dumped waste from the southern quarry in the northern quarry after it was abandoned.

3.7.3. Reference is made to large amounts of unauthorised development in the southern part of the quarry including a lorry park, the erection of security fencing and the conversion of a retaining wall into a shed. The applicant has also incorporated

unauthorised artificial lighting at night. Significant problems arise from dust deposition in and around the houses in the vicinity of the site. There appears to be anomalies in the dust deposition survey carried out and it is suggested that the data presented is just not credible. Concern is also expressed regarding the visual impact of the quarry.

.7.4. The application fails to address the impact of the levels of traffic to and from the quarry from the N15. Traffic is a major source of noise and dust pollution. The movement of cattle across the road to other fields in and around the quarry cannot be carried out during normal work hours as a result of quarry traffic.

.7.5. The revised remedial EIS is generic in nature and does specifically deal with the bespoke issues associated with the current quarry operations.

3.8. **Submission from Stuart Kirkpatrick**

.8.1. It is argued that the applicant has had to endure "this nightmare on my doorstep for the past 40 years" and while the applicants have had ample opportunities to abide by the planning laws over the years they continue to work on new developments without getting planning permission. The non-technical summary submitted with the EIS is 'a bland uncritical generic report'.

.8.2. The berms surrounding the north quarry has obliterated scenic views along the roadway and is inadequate in terms of safety and security.

.8.3. Concern is expressed in relation to quarry traffic. The revised application clearly displays a complete lack of appreciation at the impact of blasting. An Bord Pleanála are requested to take a firm stand and stand up for the residents in the vicinity by refusing this application.

3.9. **Further Submission from Pierce O'Gorman**

.9.1. This submission states that it is inappropriate that any proper Planning Authority would grant planning permission for a development that has resulted in the creation of a massive permanent hazardous environmentally damaging quarry such as the north quarry. A grant of permission in this instance would be perverse and therefore substitute consent must be refused.

3.9.2. A further submission from James Gorman of Ballymagroarty states that the quarry owners have recently commenced pumping water out of the north quarry at a rate greater than 2,500 cubic metres per day and this matter has not been addressed in the revised EIS. The applicants are also continuing to deepen the floor of the south quarry through blasting and excavation. Likewise, this matter has also not been addressed in the revised EIS.

4.0 FURTHER ASSESSMENT OF THE APPLICATION

4.1.1. I have read the entire contents of the file including the revised remedial EIS and NIS submitted with the application. I have also had particular regard to the issues raised in the various observations on file and have visited the site in question.

4.1.2. I am also cognisant of the Board Direction dated 19th June, 2015 which required a substitute consent application to be submitted for the entire site. This appears to be predicated on the premise that both the north and south quarries are intrinsically linked. The assessment set out below sets out an evaluation of significant effects on the environment that have occurred on the site post 1990. While it appears from the Ordnance Survey maps that the boundary of the quarry has not significantly altered since 1995, there can be little doubt based on the relief and contouring of the aerial photographs of 1995 to 2005 that the quarry has been subject to significant excavation over this period.

I propose to assess the revised substitute consent application under the following headings:

- Principle of Development.
- Surrounding Settlement.
- Flora and Fauna.
- Hydrology and Hydrogeology.
- Dust and Air Pollution.
- Traffic.

- Visual Impact.

4.1.3. The final two sections of this assessment will evaluate the revised remedial Environmental Impact Statement submitted and a separate section will carry out an Appropriate Assessment of the works undertaken on site.

4.2. Principle of Development

4.2.1. I note from the information contained on file and in particular the letter dated 11th February, 2016 from Donegal County Council, that the Planning Authority has no objection in principle to An Bord Pleanála approving the current application for substitute consent subject to conditions set out in the original report from An Bord Pleanála under the provisions of Section 177(I) (received by the Board on 24th February, 2015).

4.2.2. The statements contained in the current county development plan do not include any policies or objectives which would preclude in land use terms, the location of a quarry in this area of the county of Donegal. The development plan recognises the importance of the extractive industry and notes that aggregates are a significant and necessary natural resource for the continued economic development of the county. Therefore, there is a need to facilitate the sustainable extraction of appropriate materials subject to minimising any adverse impacts on the natural environment.

4.2.3. While the site is not located in an area designated as being of especially high scenic amenity nor is it located adjacent to any designated views or prospects. There are nevertheless a number of policies in the development plan which seek to ensure that any quarry development seeks to preserve the character of the landscape and protect the environment generally including the prevention, limitation, elimination, abatement or reduction of environmental pollution and to protect waters, groundwaters, the sea shore and the atmosphere.

4.2.4. It is reasonable to conclude therefore, that the principle of quarry development on the subject location would not contravene any specific policies and provisions contained in the development plan. Notwithstanding this point, the Board must satisfy itself that the quarry in question meets the qualitative safeguards set out in

the more detailed policies and objectives contained in the development plan and this issue is explored and evaluated in more detail under the various separate headings set out below.

4.3. **Surrounding Settlement**

4.3.1. The EIS states that there are four occupied dwellings within 250 metres of the subject site and 14 dwellings within 500 metres of the subject site. The revised remedial EIS does not however include a map indicating the location of the dwellings in question. Having visited the site, I noted that a number of dwellings in the vicinity of the site are currently unoccupied but may have been occupied in the more recent past. One of the dwellings is located adjacent to the access road which separates the northern and southern portions of the quarry. This dwelling is located less than 50 metres from the boundary of the northern quarry and likewise less than 50 metres from the boundary of the southern quarry. This dwelling was occupied at the time of my site inspection. There is no information on file which indicates that this house is under the ownership of the quarry operators. Likewise there is no information contained on file which indicates that the occupant of this house is one observers objecting to the development.

4.3.2. It is inconceivable in my view that, where a planning application were to be lodged for a quarry or an extension of a quarry that quarrying works would be permitted in such close proximity to a third party dwelling, due to the potential adverse effect on residential amenity. It is also inferred from the third party observations contained on file that other dwellings in the immediate vicinity were vacated primarily on the grounds that the quarry in question was having an unacceptable impact on the amenity of residents in the vicinity.

4.3.3. A critical issue in determining whether or not the quarry has had significant environmental impacts on the amenity of surrounding residents relates to the separation distance between the active quarry and the residential dwelling in question. In this instance active extraction including blasting, excavation and processing of material has occurred within 70 metres of a third party dwelling. In the case of the north quarry, rock has been excavated to a depth in excess of 100 metres. The eastern face of this quarry is c.70 metres from the western gable of the third party dwelling. In the case of the concrete batching plant, buildings associated

with this processing activity are located less than 50 metres from the third party dwelling. It is very doubtful in my view, that were a planning application lodged in respect of these activities, that a Planning Authority would permit the juxtaposition of such activity with third party dwellings.

4.3.4. It is also apparent from the observations contained on file that a number of observers have wished to relocate and retire to property in the vicinity of the subject site but have been discouraged from doing so due to the nature of the activities being undertaken at the quarry. In this regard I would refer the Board to the original observation submitted by Mrs. Mary Cosgrove and Mr. Hugh Gorman.

4.3.5. In conclusion therefore I would consider the proximity and encroachment of the quarrying activities to be a significant and material consideration in the Board's determination of the substitute consent application. The Board should be mindful of the fact that the quarrying activity in this instance has occurred adjacent to, and particularly in the case of the north quarry, contiguous to the quarry boundaries thereby bringing active quarrying to the doorstep of third party dwellings surrounding the site. This is a significant and material consideration in assessing both the historical and ongoing environmental impact arising from the development.

4.4. **Flora and Fauna**

4.4.1. As in the case of most applications for substitute consent, it is problematic to try and retrospectively assess the impact of quarrying activity on flora and fauna which have long since been removed from the site. Having regard to the historical aerial photographs, and the fact that it appears that in 1995 much of the existing vegetation and overburden had been stripped off the site, it is likely that the impact of quarrying activity subsequent to February 1990, has been minimal on the flora and fauna of the site. I do note however that the revised or remedial EIS states that no specific survey were carried out for certain species on the site such as bats. The survey in relation to flora was also limited and was restricted to a walkover of the site carried out in November. It is also somewhat confusing in that throughout the revised remedial environmental impact statement reference is made to the application site as being the north quarry only when in fact the revised remedial environmental impact statement should have referred to the entire quarry for the purposes of the assessment.

1.4.2. It is also somewhat surprising that the revised remedial environmental impact statement, in attempting to ascertain the significant effects on the environment that have occurred on site as part of the substitute consent application, has made no reference whatsoever to the original application refused by the Board under Reg. Ref. PL05.131103. While this application was refused by the Board for two reasons including a reason relating to the inadequacy of the EIS, there nevertheless includes some baseline information dating from 2000 and 2001 which should have been used in order to retrospectively assess the environmental impact arising from works carried out subsequent to this date.

1.4.3. For example, the EIS prepared in respect of the previous application (PL05.130131) notes that fields in the vicinity of the site are well preserved examples of unimproved pasture containing wet hollows and while "*nationally such habitats are a significant, unimproved limestone grassland is common in the area the fields proposed for quarrying are not as floristically diverse as some others in the immediate area*". The previous inspector's report also notes the paucity of information in relation to flora and fauna and the fact that there is no reference to the receiving environment and the type of habitats likely to be present. The lack of systematic survey in respect of flora and fauna in the current revised remedial EIS is also noted.

1.4.4. Therefore, in relation to flora and fauna I consider that it is likely that the environmental impact arising from works carried out post-1990 on flora and fauna is likely to be not significant having regard to the aerial photographs which suggest that a significant area of the site was cleared subsequent to 1990. However, it is considered that the surveys carried out in respect of the current revised remedial EIS were modest in content. Furthermore, no reference is made in the current EIS to the previous baseline studies in respect of flora and fauna in respect of the previous application lodged with the Planning Authority and appealed to the Board in 2003.

4.5. Hydrology and Hydrogeology

4.5.1. Observations submitted to the Board in respect of the current application for substitute consent expressed a number of concerns in respect of hydrology and hydrogeology, particularly in respect of groundwater discharges off site from the northern quarry. The information contained on file indicate that the northern quarry was excavated to a depth of 110 metres c.52 metres of which was below the water table. This necessitated largescale pumping of groundwater to an adjacent stream/ditch to the north of the quarry which discharges into the Ballymagroarty Stream which in turn flows into Durnesh Lough to the north-west of the subject site.

4.5.2. It is arguable whether or not a Planning Authority would have permitted such largescale excavation below the water table in the absence of detailed hydrogeological investigations. Notwithstanding this point, water discharge from the northern quarry was the subject of a discharge licence (under Reg. Ref. WW05F.WW0330). The impact of groundwater discharges off site therefore was the subject of detailed investigation and evaluation. The Board considered such a discharge to be acceptable subject to compliance with various quality standards (for pH, suspended solids, total ammonia, total phosphorous and aluminium). Furthermore, the Board restricted the volumetric flow per day to 700 cubic metres.

4.5.3. It is clear therefore that both the Planning Authority and the Board have evaluated historic discharges from the site when ground water pumping was being undertaken in the northern quarry and the Board deemed this discharge to be acceptable subject to appropriate conditions. The remedial EIS in my view has demonstrated from monitoring results upstream and downstream that the quarry has largely been in compliance with the discharge licence and parameters set out in the licence granted by the Board (WW05F.WW0330). Monitoring has also indicated that groundwater quality at the site complies with groundwater regulation threshold value ranges and groundwater quality at monitoring locations have indicated that the groundwater complies with legislative requirements.

4.5.4. In terms of groundwater drawdown and its consequential impact on the cone of depression, the revised remedial EIS indicates that local experience of the groundwater regime in the area suggests that any quarrying dewatering would have caused a steep cone of depression with a limited radius. There is no evidence to

suggest on the information contained on file or the observations submitted that the groundwater pumping regime has had any adverse impact on local wells or water supply schemes in the vicinity. Nevertheless, the site is underlain by a Regionally Important Aquifer which is karstic in nature. Such aquifers are generally characterised by faster groundwater flows which higher densities of cracks and fissures. It might therefore be expected that the cone of depression might be more extensive than that suggested in the studies undertaken in the EIS.

4.5.5. With regard to volumetric discharges from the northern quarry, I would refer the Board to Appendix B of Appendix 2 of the revised remedial Environmental Impact Statement which contains details of the volumetric discharges from the northern quarry from 2011 to 2013. The figures indicated that there have been numerous breaches of the 700 m^3/d limit set out in the discharge licence. Notwithstanding these breaches, there is no evidence to suggest that this has resulted in an adverse environmental impact on the receiving waters of Ballymagroarty Stream or Durnesh Lough. In support of this conclusion I refer the Board to the submission from the Department of Arts, Heritage and the Gaeltacht dated 29th January, 2015 contained on file which notes that "*the hydrological situation appears to be stable and is not considered a threat to the integrity of the adjacent watercourses or designated sites further downstream*".

4.5.6. Similar conclusions can be arrived at in my opinion in respect of any water discharge from the southern portion of the quarry. Under Reg. Ref. PL05WW.0303 Donegal County Council granted a licence, a decision which was upheld by the Board, in the southern part of the quarry to discharge effluent arising from dust suppression systems and surface water run-off. Again the surface water discharges to an open drain which ultimately discharges into Durnesh Lake. The water management system and discharges arising from the site was the subject of detailed scrutiny and evaluation under this application and the Board deemed the discharge to be acceptable and in accordance with the provisions of the Water Pollution Act as amended.

4.5.7. In conclusion therefore, and notwithstanding breaches which may have occurred in respect of the volumetric discharge off-site from the northern quarry, I consider that any historic and current discharges from the site have been the subject of appropriate scrutiny and evaluation and I consider it reasonable to conclude that any

such discharge have not had an adverse impact on the receiving environment. Likewise, notwithstanding the karstic nature of the underlying aquifer, it appears that any cone of depression that arose as a result of pumping groundwater off site, did not adversely affect wells or water supply in the vicinity.

4.6. **Dust and Air Pollution**

.6.1. Dust deposition appears to be a significant issue in my opinion particularly having visited the site and noted the size and scale of the activities undertaken on site. The quarry processes between 150,000 and 250,000 tonnes of rock per year. In addition to blasting and excavating, aggregate is crushed and screened on site and aggregate is also processed in the concrete batching plant. The potential or dust generation is therefore significant and largescale dust deposition was noted within the site and on the access roads in the vicinity of the site during my site inspection. I refer the Board to the photograph attached which shows silt laden run-off from the main access road serving the quarry onto the N15. I also refer the Board to the inspector's report in respect of the previous application on site (PL05.131103). It notes that dust was identified by Donegal County Council as being a major issue in respect of the operations. I further note the inspector's report on page 28 which states "*on the date of inspection, the quarry was not in full operation due to summer holidays. Weather conditions were dry with no wind. There was dust evident along the local approach roads to the site and on the surrounding vegetation*". The Board should also be cognisant of Figure 6 in the submission from Pierce O'Gorman received on 15th February, 2016. It indicates largescale dust deposition on a vehicle and this attributed to the quarry in question.

.6.2. The revised remedial EIS submitted indicates in Table 8.3 dust deposition monitoring results on various dates from 2007 to 2015. In total 375 readings are presented in Table 8.3 at five separate monitoring locations at the quarry. On 10 occasions according to the data presented, the TA Luft Guideline of 350 g/m^2/day was exceeded. This represents an exceedance of approximately 3%. It should be noted however that in some cases the exceedance was 3 to 4 times the guidance limit.

1.6.3. A key consideration in relation to the impact of dust, is the location of the dust monitoring points for the purposes of the assessment. Three of the five dust monitoring locations are located along the south-western boundary of the site. As the prevailing wind as indicated in the Wind Rose contained in the revised remedial EIS indicates, the predominant wind direction is from the south-west. These dust monitoring points are therefore located downwind of the quarry and therefore in my opinion would not record the highest dust deposition rates. It would be more appropriate in my view that the dust deposition monitoring points would be located along the north-eastern boundary of the southern quarry where aggregate is stockpiled and processing of materials are taking place. Having regard to the prevailing wind direction it is most likely that the lands to the immediate north-east of the southern part of the quarry are most likely to experience highest levels of dust deposition. The results recorded therefore are unlikely to represent a worst case scenario in terms of dust deposition.

1.6.4. I note that no detailed odour assessment was undertaken in respect of the asphalt plant which is currently operating on site in the revised remedial EIS. Malodour was a material issue raised in the submissions to the Board. It appears that the plant was constructed without the benefit of planning permission. However, an air pollution licence was sought for the operation of the plant and Donegal County Council issued notification to grant the licence and this was subject to a third party appeal. Notwithstanding the concerns raised in the third party objection, the Board upheld the decision of the Planning Authority and granted the licence in October, 2005. The impact of the proposed asphalt plant has therefore been assessed and deemed to be acceptable.

4.7. Noise and Vibration

1.7.1. Section 9 of the revised remedial EIS deals with the issue of noise and vibration. Noise was raised as a significant issue in respect of the previous application and determination by the Board under PL05.131103. Details of three separate noise surveys undertaken in the vicinity of the site in May, 2008 and two in October, 2014 are set out in the revised remedial EIS. There can be little doubt that the proximity of the N15 National Primary Route contributes significantly to noise levels particularly for dwellinghouses located to the south-east of the quarry. However, I would

anticipate that quarry activities are likely to contribute materially to noise levels at noise sensitive receptors to the immediate north of the southern quarry and dwellinghouses to the west of the northern quarry having regard to the more rural location away from arterial traffic routes. The surveys indicate that noise levels at these two locations (N3 and N4) in relation to the survey undertaken in 2008 have L_{aeq} levels of between 55 and 56 dB(A) and 39 and 41 dB(A) respectively. In the case of the more recent noise surveys the monitoring results indicated noise levels of between 47.9 and 54.7 in the case of monitoring location N1 (to the immediate north of the southern quarry) and 48.9 in the case of N2. N4 which is located at the south-western corner of the main quarry area recorded noise levels of between 53.4 and 54.4 dB(A) L_{aeq} on the more recent surveys undertaken in October, 2014.

.7.2. I carried out spot noise surveys during my site inspection in November 2016. I stress that the survey was not a comprehensive or scientific survey such as the surveys carried out in the rEIS. The spot survey undertaken by myself is not aimed at replacing or invalidating the surveys undertaken in the rEIS. The Board should place greater emphasis on the surveys contained in the r EIS as these surveys were carried out in accordance with appropriate methodologies. The spot survey undertaken during my site inspection recorded noise levels higher than those contained in the r EIS and give an indication of the background noise levels in the vicinity of the site during the quarry operations on the day of my site inspection.

7.3. At the front of the dwelling house to the immediate east of the North Quarry and adjacent to road which traverses the north and south quarries, I recorded noise levels, of between 60 and 90 dB(A). (The L_{eAq} is more likely to be at the lower end of this range). There can be no doubt that quarrying activity was the dominant source of noise during the c 1 min long survey and not traffic on the N15, as indicated in the rEIS. My site inspection would suggest that, at the very least, further detailed noise surveys and investigations would be required before a conclusion could be reached that noise levels emanating from the quarry would be acceptable in terms of impacting on amenity.

7.4. It is extremely likely that noise levels emanating from the operations would have been greater during the period under which excavation was occurring at the north quarry (according to the information contained on file quarry operations ceased in the north quarry in 2013). I note however that this is not reflected in the survey

undertaken in 2008. Ambient noise levels in 2008 were actually recorded as being lower than those associated with the latter surveys despite the fact that quarrying operations in the northern quarry had ceased by October, 2014.

4.7.5. The remedial EIS comes to the conclusion "*that it is not anticipated that there will be an adverse impact in relation to noise and vibration associated with the application site on neighbouring landowners and dwellings in the vicinity of the application site*". The rationale for coming to such a conclusion is not adequately explained in the Impact Assessment in this section of the EIS. It is assumed that this conclusion is predicated on the statement in Section 9.3.1 of the EIS which suggests that noise from the activities on site shall not exceed 55 dB(A) between 0800 and 2000 hours and 45 dB(A) during night-time hours. The quarry does not operate at night-time therefore the critical assessment relates to daytime only. In my opinion it is not sufficient to merely come to a conclusion that the proposed operations are acceptable on the basis that they adhered to (albeit marginally) the maximum permissible limit of 55 dB(A).

4.7.6. It will be more appropriate in my opinion that any noise assessment would also make reference to the criteria set out in BS4142 in relation to noise impact assessment. Any reasonable noise assessment methodology would assess the proposed development in terms of baseline ambient noise levels which could be expected in a rural area. Typical noise levels in a rural area would generally range from between 40 and 50 dB(A) and more typically below 45 dB(A). L_{Aeq} levels at nearest noise locations are recorded as being in the region of 50 to 55 dB(A). This represents an increase in noise levels of between 5 and 10 dB(A) above that that could normally be expected in a rural area.

4.7.7. Furthermore, BS4142 suggest that a rating level should be incorporated for certain acoustic features which can increase the likelihood of complaint over that expected from a simple comparison between specific noise level and the background noise level. It suggests the application of a 5 dB(A) correction where noise contains a distinct tonal characteristic (a whine, screech, hum etc.) or incorporates an impulsive element such as blasting.

4.7.8. I consider it reasonable that a 5 dB correction could be incorporated in respect of quarrying activities where you have blasting, sirens associated with HGVs reversing

and other tonal components in the noise associated with the crushing, screening and processing of materials. Taking all the above into consideration, it would not in my opinion be unreasonable to conclude that the largescale development of a quarry at this location could result in a difference of between 5 and 10 dB (or more) above that associated with ambient noise levels in a rural area.

.7.9. Notwithstanding the anomalies set out in the noise survey undertaken, it is likely in my opinion that overall noise levels were likely to be greater historically when the northern quarry was operating and therefore were likely to adversely impact on surrounding residential amenity. Based on the above assessment I would consider it reasonable to conclude that the size and scale of operations undertaken historically would have had an unacceptable impact on surrounding residential amenity in terms of noise.

.7.10. In relation to blasting and vibration, I note that blast monitoring results are set out in Table 9.4 of the EIS. Again comprehensive and frequent details are provided for the six-year period between 2007 and 2013. In terms of combined peak particle velocity there was an overall compliance rate of 97%. In terms of air overpressure there was a compliance rate of 98%. I have no reason to doubt the veracity of the information contained in the revised remedial EIS and I can therefore only conclude that the blasting operations undertaken on site were generally acceptable in terms of the impact on surrounding residential amenity. In terms of blasting and extraction, I would request the Board to note that normal good practice requires the incorporation of benching in the creation of quarry faces particularly in terms of health and safety. The Board will note that the northern quarry area despite being excavated to a depth of 110 metres did not incorporate any such benching. Had the extraction been the subject of a planning application it may have been a requirement to incorporate such benching for health and safety reasons.

4.8. **Traffic**

I note the contents of the Traffic Section in the revised remedial EIS. It assesses the impact of the historic operations on site when the north quarry was operating and the overall traffic associated with the main quarry during the peak season amounted to some 99 trips per day (including staff, customer and HGV trips). The site is located in

close proximity to the N15 National Primary Route which has an AADT of 6,800 vehicles per day of which 6% are HGVs (c.550 vehicles). I consider that the proposed development would have had an acceptable impact on the road network in terms of traffic. I consider that the national primary route which is located adjacent to the subject site has ample capacity to cater for the peak traffic generated by the site historically.

4.9. **Visual Impact**

4.9.1. I would have significant concerns in relation to the visual impact arising from the works on site. There are numerous photographs contained on file particularly those furnished by the observers which indicate the profound visual impact arising from the quarry including views from the N15. I refer the Board to the photographs attached to this report, which equally in my opinion, depict the profound adverse visual impact arising from works undertaken on site to date. The area of extraction extends to over 11 hectares. The site accommodates numerous large buildings, silos, plant and machinery and stockpiles of aggregate and in my view represent a significant blot on the landscape. While I fully acknowledge that the lands on which the site is located are not designated as lands of special scenic amenity and that quarry by their very nature will alter the natural landscape, I nevertheless consider that the totality of the operations on site would constitute a very important and material consideration in assessing any planning application for a quarry on the size and scale proposed. It is in my opinion difficult to come to any other conclusion that the quarry in question would not have a profound impact on the visual amenities of dwellings in the vicinity particularly dwellings in the wider area to the north and west of the subject site.

4.9.2. To illustrate this point I would refer the Board to the photographs submitted in the original observation by Stewart Kirkpatrick which provides a panoramic view of the landscape towards Donegal Bay and beyond. The development of a quarry and associated facilities at this location has profoundly altered views in the wider area.

The access road and right of way which currently runs through the southern portion of the quarry and separates the north and south quarries has become indistinguishable as a result of the works undertaken. This right of way resembles an internal haul route within the overall quarry and is no longer discernible as a right of way.

4.9.3. Finally, in relation to the visual impact I consider that the construction of the berms around the northern quarry has likewise impacted on the visual amenities of the area in that it has obscured and screened panoramic views of the countryside in a north-easterly direction which in turn has had an adverse impact on the visual amenities of the area.

5.0 CONCLUSIONS AND RECOMMENDATIONS IN RESPECT OF THE APPLICATION FOR SUBSTITUTE CONSENT

5.1.1. Based on my assessment above, I consider that the historic works which have been undertaken on the entire site would have had an unacceptable impact on the residential and environmental amenities of the area primarily through the unacceptable visual impacts arising from the development and adverse impacts on amenity, particularly in terms of noise and dust. On foot of this assessment I recommend that the Board refuse to grant substitute consent for the current application before it.

6.0 ENVIRONMENTAL IMPACT ASSESSMENT

6.1.1. Having read the revised remedial EIS document submitted with the application, I am generally satisfied that the information contained in the document identifies the major environmental issues which would have likely arisen as a result of historic operations on site and attempts to describe and identify the main direct and indirect as well as cumulative environmental impacts which occurred as a result of the proposed development. However, I am not satisfied that the EIS correctly and adequately quantifies and assesses all the impacts which would have occurred historically on

the site subsequent to 1990. The evaluation of the revised remedial EIS is assessed in more detail below.

6.1.2. I am satisfied that the document describes the processes undertaken at the quarry and sets out in detail the activities relating to the existing development. The Board will note however that throughout the entire document, reference is made to "the application site" as being the north quarry only and not the entire quarry, notwithstanding the fact that the revised remedial EIS was required to assess the project in its entirety (i.e. north and south quarries). Notwithstanding this point the characteristics of the existing development together with all the processes undertaken on the site are, in the main, adequately described in the document.

6.1.3. Section 3 of the EIS relates to human beings. It describes details of the existing environment in terms of population demographics and economic activity in the area. It also details social structure in the area. The impact which has occurred on human beings are identified and assessed in subsequent chapters of the revised remedial EIS.

6.1.4. Section 4 of the EIS relates to flora and fauna. Designated sites in the wider area are identified (for further assessment of designated sites please see Appropriate Assessment section below). With regard to survey methodology, I note that the EIS included a habitats survey and a bird survey. However, no specific surveys were carried out for other species such as bats due to the time of year and which the survey was undertaken. This may result in gaps or lacuna in the information necessary to adequately evaluate the environmental impact arising from the development. Again the section on flora and fauna (page 4.11) refers to "*much of the area within the application area consists of a large lagoon exposed quarry faces and bare ground supporting little vegetation*". This again infers that the detailed ecological investigation may have been restricted to the northern quarry only. Notwithstanding the above conclusion I do acknowledge that it is likely that a substantial portion, if not all the quarry, was established prior to 1990 and that works undertaken subsequent to that date may have been on the whole restricted to the excavation of the existing area. Therefore, it is likely that works undertaken post-1990 would not have a significant adverse impact in terms of habitats and terrestrial flora and fauna within the site.

5.1.5. Chapter 5 of the revised remedial EIS relates to soils and geology. I am generally satisfied that this section of the EIS provides baseline information in relation to the receiving environment including soils, bedrock geology and karst features which may have existed on site prior to excavation. I am also satisfied that the EIS has identified, described and assessed the impact of the quarry on the geology and soils of the area.

5.1.6. Section 6 of the EIS relates to hydrology and hydrogeology. I am satisfied that the document has adequately described the existing environment in terms of topography and drainage and hydrology and hydrogeological characteristics. The EIS has correctly identified the main environmental impact in terms of hydrology and hydrogeology as being discharge of water off site to surrounding surface water bodies. The impact of such discharge particularly the historical impact arising from groundwater being pumped from the north quarry has been assessed and this has included a review of historical monitoring data. The review indicates overall compliance with environmental obligations as specified in water quality standards for both for the north and south quarries.

5.1.7. In terms of groundwater the EIS draws on local experience of the groundwater regime to support the conclusion that dewatering resulted in a steep sided cone of depression which did not affect surrounding groundwater resources. This conclusion in my opinion my not sit comfortably with the underlying karstic geology which may suggest greater levels of drawdown in the groundwater. No evidence has been presented that groundwater supplies ot well have been significantly affected as a result of the pumping undertaken, particularly at the north quarry. In my opinion therefore it is considered that the potential environmental impacts have been identified and described and adequately assessed in the revised remedial impact statement submitted with the application.

5.1.8. Chapter 7 relates to climate. It identifies the main potential impact arising from the proposal relates to changes in the climate through increased emissions. The document reasonably concludes in my opinion that it is unlikely that the activities undertaken on site would have led to a significant contribution to emissions to the overall environment.

3.1.9. Chapter 8 of the EIS relates to air quality. The EIS correctly in my view identifies the main environmental impact which could arise as a result of the works undertaken is fugitive dust deposition through processes undertaken at the quarry site. The wind and dust deposition regime are adequately described in the EIS. However, the impact assessment in my view may have underestimated dust deposition on lands to the north-east of the site. This is primarily due to the location of the dust monitoring positions which were not located downwind of the prevailing wind direction.

3.1.10. Chapter 9 of the EIS relates to noise and vibration. The potential noise sources are adequately identified and described in the EIS. These are attributed to the processing of materials and the operation of plant and machinery associated with the EIS. While the remedial EIS attempts to identify the historic noise generation associated with the quarry activity undertaken on site, I consider based on my site inspection, that the historic noise regime associated with the operations on site may have been somewhat underestimated. I also consider having visited the site that background noise levels may have over attributed ambient noise levels on traffic associated with the N15 and may have underestimated the contribution of quarry activity in background noise levels.

3.1.11. I further consider that a more robust evaluation should have been undertaken in the context of the criteria set out under BS4142 in that a noise rating penalty should have been attributed to the quarrying activities due to tonal or impulsive noises which are characteristic of quarry operations. Furthermore, L_{Aeq} levels recorded as a result of the noise survey should have been assessed in the context of typical ambient rural noise levels in order to assess a more accurate picture under which quarrying activities may be contributing to ambient noise levels in the area. Therefore, while I acknowledge that the noise section of the remedial EIS attempts to evaluate the historic impact of quarrying activities on the noise regime of the area, this impact in my view may have been somewhat underestimated. I am satisfied that the revised remedial EIS adequately assesses the impact of the historic works in terms of blasting and vibration.

3.1.12. Section 10 of the EIS relates to traffic. The EIS correctly identifies the main adverse impact arising from works undertaken relates to increased traffic movements and in particular increased HGV movements. I am satisfied that the EIS has assessed the proposal in terms of historic peak traffic arising from the development and I am also

satisfied that the EIS has adequately demonstrated that the existing road network could adequately cater for this traffic and as a result the environmental impact is deemed to be acceptable.

.1.13. Section 11 of the EIS relates to landscape and restoration. Having visited the site in question and having had particular regard to the visual impact arising from the size and scale of the works undertaken I consider that the conclusions reached in the EIS may have understated the visual impact arising from the works undertaken. I acknowledge however that this is a subjective opinion and the Board may decide otherwise.

.1.14. Chapter 12 of the EIS relates to material assets. The main assets identified in the EIS include residential buildings, geological resource, land resource, public road network and access, public utilities, scenic routes and tourism. I am satisfied that works undertaken on the site to date have not adversely impacted on material assets.

.1.15. Section 13 of the EIS relates to archaeology and cultural heritage. The EIS states that there are no recorded monuments situated within the substitute consent area. The closest monument is located 80 metres to the north-east of the site and was not impacted upon as a result of works undertaken. The remedial EIS states that the quarry was subject to a cultural heritage assessment in 2008 and was subject to archaeological testing and monitoring in 2001. Both investigations found nothing of archaeological significance. Having regard to the nature of the development in question and the likelihood that most if not all of the site was stripped of overburden and subsoil prior to 1990 the conclusions set out in the EIS that there is nothing of archaeological significance within the boundary of the substitute consent application is reasonable in my view.

.1.16. Finally, the EIS sets out the interactions and inter-relationships in respect of the various potential environmental impacts. In conclusion therefore I consider that the revised remedial EIS submitted, while attempting to identify and describe and assess the significant environmental impacts which could have arisen as a result of the works undertaken on site, these effects may have been somewhat underestimated particularly in relation to noise, fugitive dust and visual impact.

7.0 APPROPRIATE ASSESSMENT

7.1.1. Under QV05E.0128 the Board in its decision set aside the determination by Donegal County Council to close the quarry and sought an application for substitute consent accompanied by both an EIS and an NIS as per the provisions of section 261A(a) 2(a)(i) and 2(a)(ii). The applicant in his response, submitted a remedial Natura Impact Statement which was revised in December, 2015.

7.1.2. The NIS identifies eight Natura 2000 sites within 10 kilometres of the study area. The NIS reasonably in my view initially screens out most of these European sites due to the distance separating the quarry from the subject sites and the fact that there is no source – pathway – receptor connections.

7.1.3. Two European sites, the Ballintra SAC (located 1.9 kilometres north-east of the subject site), and Durnesh Lough SAC (located just over 2 kilometres to the west of the subject site) have been screened for the purposes of appropriate assessment. These two Natura 2000 sites, based on the precautionary principle, have the potential to be affected by the activities undertaken at the quarry.

7.1.4. Ballintra SAC has two qualifying interests, limestone pavement and wet heath. The limestone pavement is a priority habitat. The conservation objective is to maintain the Annex I habitats for which the SAC has been selected at favourable conservation status.

7.1.5. Durnesh Lough comprises of a large sedimentary lagoon which is separated from the sea by a barrier composed partly of drumlins, partly of sand dunes with the remains of a cobble barrier occurring in places. Water is connected to the sea by an artificial channel and pipe running under the sand dunes. The qualifying interests include coastal lagoons and molinia meadows on calcareous peaty or clay silt laden soils. Both of these habitats are priority habitats. The conservation objective is to maintain or restore the favourable conservation condition of these Annex I habitats.

7.1.6. Durnesh Lough is also an SPA. The features of interest are the Whooper Swan and the Greenland White Fronted Goose. The conservation objective is to maintain or restore the favourable conservation condition of the bird species.

7.1.7. In the case of Ballintra SAC, the NIS submitted correctly in my view concludes that works undertaken at the subject quarry has not resulted in any direct habitat loss,

damage or fragmentation. Furthermore, it has not resulted in any changes to the hydrological regime as there are no direct surface water pathways linking the quarry to the Ballintra SAC.

7.1.8. In relation to the Lough Durnesh SAC and SPA, the NIS also reasonably concludes in my opinion that the quarrying works undertaken has not resulted in any direct loss, disturbance or fragmentation to Lough Durnesh SAC or SPA. Durnesh Lough is hydrologically linked to the quarry via the Ballymagroarty Scotch River and the quarry has discharged groundwater to this stream. However, the discharges in question have been subject to licence which required water sampling to be carried out on a frequent basis. Both the remedial EIS and remedial NIS state that no exceedances have been noted in the water quality samples undertaken and no pollution incidences were detected. Therefore, there have been no direct effects of the quarrying work undertaken on the qualifying interest or the conservation objectives associated with Durnesh Lough SAC and SPA.

7.1.9. In terms of indirect effects, it is possible that the feeding grounds for the birds which form qualifying interests associated with the SPA could be affected by changes in water quality. However, it is apparent that water quality was not affected by the discharges from the quarry and as such it is highly unlikely that feeding grounds would have been altered within the lough. In terms of in-combination effects, there is no evidence to suggest that in-combination effects occurred with other discharges into the stream which forms a hydrological connection between the quarry and Durnesh Lough SAC and SPA. I would fully agree with the conclusions contained in the NIS that the qualifying interests of the European Sites in the vicinity will in no way be adversely affected but the works that have been undertaken on the subject site.

7.1.10. In conclusion therefore I consider it reasonable on the basis of the information on file which I consider adequate in order to carry out a Stage 2 Appropriate Assessment that the quarrying operations undertaken on the subject site individually or in combination with other plans or projects has not adversely affected the integrity of the Ballintra SAC (Site Code: 000115) or the Durnesh Lough SAC (Site Code: 000138) and Durnesh Lough SPA (Site Code: 004145) or any other European site in view of the site's conservation objectives.

RECOMMENDATION

Arising from my assessment above I consider that the Board should refuse to grant substitute consent for the quarrying works undertaken on the subject site in accordance with section 177K of the Planning and Development Act, 2000 based on the reasons and considerations set out below.

REASONS AND CONSIDERATIONS

In coming to its decision the Board had regard to the following:

(a) The provisions of the Planning and Development Acts 2000 to 2015 and in particular Part XA,

(b) The Guidelines for Planning Authorities and An Bord Pleanála on carrying out environmental impact assessment issued by the Department of Environment, Community and Local Government in March, 2013,

(c) The Quarries and Ancillary Activities Guidelines for Planning Authorities issued by the Department of Environment, Heritage and Local Government in April, 2004,

(d) The provisions of the current Donegal County Development Plan,

(e) The remedial Environmental Impact Statement submitted with the application for substitute consent and the documentation on file generally,

(f) The submissions made in accordance with Regulations under section 177N of the said Act as amended,

(g) The pattern of development in the area,

(h) The nature and scale of the development of this application for substitute consent, and

(i) The report of the Board's Inspector specifically in relation to potential significant effects on the environment,

on the basis of the information submitted in support of the applicant for substitute consent the Board considered that the existing works undertaken on site has given rise to significant adverse amenity impacts particularly in respect of noise, dust and visual impact. The development would, therefore, be contrary to the proper planning and sustainable development of the area.

Paul Caprani,
Senior Planning Inspector.

28th November, 2016.

APPENDIX 2-2

Comhairle Contae
Dhún na nGall
Donegal County Council

Ms Marie McDevitt,
Director,
Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Donegal,
Co. Donegal.

25th January 2016

c.c. Patrick O'Donnell, Earth Science Partnership Ire. Ltd., Tonranny, Westport, Co. Mayo.

Re: P. McCaffrey & Sons Ltd. - licence review.

Enclosed reviewed discharge licences for P McCaffrey & Sons Ltd. reference numbers Lwat41 and Lwat48.

Yours sincerely,

S. Mc Menamin

Shirley McMenamin,
Senior Executive Technician.

Comhairle Contae
Dhún na nGall
Donegal County Council

LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977

LOCAL GOVERNMENT (WATER POLLUTION) (AMENDMENT) ACT, 1990.

Licence to discharge trade effluent to waters

LOCAL AUTHORITY **DONEGAL COUNTY COUNCIL**

Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Co Donegal.

Reference Number in Register: **Lwat 41.**

Donegal County Council in exercise of the powers conferred on it by the Local Government (Water Pollution) Act, 1977 and the Local Government (Water Pollution) (Amendment) Act, 1990 hereby grant an effluent discharge licence to discharge effluent from the premises of Patrick McCaffrey & Sons Limited, at Ballymagroarty Irish, Glasbolie, Ballintra, Co Donegal, known as the North Quarry to the receiving waters of Durnesh Lake subject to the following conditions:

1. General layout and Operations:

1.1 This licence shall be in respect of the discharge of trade effluent arising in that part of the licensee's lands known as the North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal. Only quarry water arising in the North Quarry shall be discharged as effluent.

1.2 The licensee shall install and maintain adequate treatment facilities to ensure that the effluent discharging from the premises of The North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal, complies with the effluent discharge licence conditions at all times.

1.3 The North Quarry site shall be laid out, operated and maintained in such a manner as to prevent the discharge of any polluting matter to the receiving waters other than via the wastewater treatment system.

1.4 All clean unpolluted waters upstream from the discharge location must be directed to the receiving waters of Lake Durnesh, by a route free from pollution.

1.5 No domestic sewage or hydrocarbon oils shall be discharged with or allowed to mix with the effluent arising in the North Quarry.

1.6 The licensee shall ensure that all contaminated run off from the site goes directly to a sealed treatment area/ lagoons/ settlement ponds without causing pollution of any waterway and is retained there until it is treated and from there discharges to the stream under licence conditions.

Drainage channels should be constructed sufficiently deep enough to facilitate high flows during heavy rainfall.

1.7 The licensee shall ensure that there is no structural cracks/defects in the settlement ponds/ lagoons, that they are appropriately lined using stiff clay/liner, and that they are of such a size as to store all effluent, without leaks or overflow, until the effluent is discharged to the river in compliance with the effluent discharge licence.

1.8 The settlement lagoons/ponds shall be arranged so as to work in series. A suitable maintenance strategy is required in order to maintain operating efficiency & minimise the disruption to the settlement process during dredging procedures.

1.9 The licensee shall not dispose of any sludge arising in the settlement ponds or lagoons or other areas of the North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal other than in accordance with the Waste Management act 1996. Records of all waste disposal operations must be maintained and made available to persons authorised under the Waste Management Act 1996.

1.10 In the event of pollution of the receiving waters arising from the licensee's activities. whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence, the licensee shall make good all damage resulting from such pollution, including, if necessary:

(a) the replacement of fish stocks;
(b) the restoration of spawning grounds;
(c) the replacement of shellfish stock (Freshwater Pearl Mussel);
(d) the restoration of shellfish (Freshwater Pearl Mussel) habitat.
(e) any restoration of habitat or replacement of fish/shellfish stocks should only occur following detailed consultations with and the agreement of the National Parks & Wildlife Service (NPWS).
(f) the removal of pollutant from waters;
(g) the modification of it's discharge regime to prevent recurrence;
(h) such other measures as may by directed by the Local Authority.

1.11 In the event that any observations are made by persons authorised under the Water Pollution Act 1977/90 on the quality or appearance of the surface water discharge indicating that contamination has taken place, the licensee shall:

(a) carry out an immediate investigation to identify and isolate the source of contamination,
(b) put in place measures to prevent further contamination and to minimise the effects of any contamination on the environment, and
(c) notify the Local Authority, the Inland Fisheries Ireland (Ballyshannon) and the National Parks & Wildlife Service immediately.

1.12 The licensee must submit a site environmental response plan within one month of receipt of this licence, which should outline response plans for use in the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence.

1.13 The licensee shall ensure that vehicles used for transport of materials from the premises, all roads/tracks within the site and all processing/handling equipment are maintained in a dampened condition during dry weather to prevent dust blow. All run-off from such spraying and dampening processes must be directed to the treatment (settling lagoon) system. If dust or liquid deposits occur on the public roads, drains or hedges, as a result of the operations on the site, and such deposits enter into the local drainage system, contravening the limits set in this licence, the licensee shall clean up all such deposits immediately.

1.14 All vehicles leaving the quarry site must pass through a wheelwash facility and water sprinkling system, which will ensure the damping down of the vehicle and its contents in order to prevent dust blow. The wheel wash system should be routinely cleaned & maintained so as to ensure that

no sediment is transported onto access roads, which would give rise to dust in dry weather conditions.

1.15 The wheel wash facility must be designed in such a way as to ensure that the vehicle does not come into contact with settled material, (silt). The vehicle must drive over a grid/ cattle grid type structure, allowing all contaminated waters to fall into a collection sump underneath the grid. The sump should be of such a size, as to allow the contaminated waters time to settle. The effluent from this wheel wash sump shall be directed to the treatment system, (lagoons), before discharging through the licenced discharge point, under licence conditions to the receiving waters of Lake Durnesh.

1.16 All oil/petrol/ diesel storage tanks shall, as a minimum, be bunded to a volume of not less than 110% of the capacity of the largest tank or drum within the bunded area. Bund tanks must not have valve arrangements for surface water disposal.

1.17 Oil interceptors shall be provided, were necessary, to ensure that the effluent discharging to the river meets licence standards.

1.18 Discharges from lorry/car washing facilities shall not enter the main oil interceptor system as detergents in such discharges can emulsify oil trapped in the interceptor and allow it to escape. Lorry/car wash effluent shall be directed to the treatment system, (lagoons) and shall not be discharged directly to any nearby watercourse.

2. **Effluent Volume and Characteristics** :

2.1 The total volume of treated effluent to be discharged shall not exceed the following limits :

Parameter	**Units**	**Limit(s)**
Volumetric flow per day (24 hours)	M^3	350
Volumetric flow per hour	M^3	14
Volumetric flow per minute	M^3	0.25
Maximum Volumetric flow in 24 hours in Winter months	M^3	700

2.2 Oils and grease shall not be present in effluent in such quantities as to :

(a) form visible films on the surface of the water;
(b) form coatings on the river bed, benthic biota or food resources;
(c) cause deleterious effects on aquatic life;

2.3 Effluent as discharged shall comply with the quality standards set out hereunder in respect of the following parameters :

Parameter	**Units**	**Limit(s)**
pH	pH units	6 – 9
Suspended Solids	mg/litre	20
Fats/oils/greases	Visual	Shall not be present in the effluent in such quantities as to form visible films on the surface of the discharging effluent.

3. **Monitoring Regime** :

3.1 An accessible safe sampling points shall be provided, which is representative of the final Discharge.

3.2 The licensee shall commission an independent accredited laboratory to analyse samples of the discharge on a quarterly basis. The samples shall be taken at a time when the quarry is in operation. The samples shall be taken so as to be representative of the effluent discharge.

3.3 The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.4 The licensee shall install and maintain an automatic flow recorder and report as in section 4 below. The licensee shall install and automatic flow related sampler if deemed necessary by persons authorised under the Water Pollution Act 1977/90, at some time in the future.

3.5 The licencee shall conduct a visual inspection of the discharge on a daily basis.

3.6 The licensee shall commission an independent accredited laboratory, once per year, to analyse samples of the receiving water into which the effluent discharges at a representative location upstream and downstream from the discharge. The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.7 The operating sediment ponds and oil interceptors must be inspected at least monthly and more frequently during heavy rainfall. A record must be kept of these inspections noting the condition of the settlement ponds, appearance of the effluent and weather conditions. This record must be available for inspection by persons authorised under the Water Pollution Act 1977/90 & reported as per 4.1.

3.8 Regular checks for embankment failure, such as seeps or erosion, must be made and a record must be kept of these checks.

3.9 The depth of sediment in the sedimentation ponds must be monitored at sufficient intervals to plan for sediment removal at minimum pond flow, but before the average sediment depth reaches 50% of the pond depth.

3.10 When new ponds are created, validation checks must be carried out when construction work is completed to ensure that the ponds are sealed and operate effectively.

4. Reporting

4.1 The Licencee shall forward to Donegal County Council an Annual Report giving the results of analysis, as per the following table;

Parameter	**Test Frequency**	**Report**
pH and Suspended Solids of the discharge	4 per year	Annual
pH, Suspended Solids of the receiving water, upstream and downstream of the discharge.	Once per year	Annual
Effluent Visual check	Daily	Annual
Settlement Pond and oil interceptor inspections	Monthly	Annual
Volume	Daily	Annual

4.2 The Annual report shall be forwarded to Donegal County Council, by the end January each year giving the previous year's results on an Excel spreadsheet to dischargeresults@donegalcoco.ie

4.3 The Annual report shall include an assessment of compliance of in-house monitoring results with licence conditions, explanations for breaches and detailed corrective/preventive action plans designed to address the root causes of non-compliances/breaches in the coming year.

5. **Access by Authorised Personnel :**

5.1 Details of emergency contact personnel, including addresses and telephone numbers, shall be forwarded to the licensing authority within one month of the date of grant of this licence. At least one such person shall be available for contact at all reasonable times, having due authorisation from the licensee to expedite emergency measures as may be required.

5.2 Authorised Officers of the Licensing Authority, or its agents, or any person authorised under section 28 of the Local Government (Water Pollution) Act 1977 as amended by section 19 of the Local Government (Water Pollution) (Amendment) Act, 1990 shall have access to the licensees site at all times.

6. **Change of use of Development**:

6.1 The licensee shall notify the Licensing Authority of any proposed change in the operation of the quarry or plant that would cause, or be likely to cause, a material alteration in the nature, or increase in the volume of effluent discharged.

6.2 No changes in relation to the discharge (flow rates, effluent concentrations) shall take place without prior written agreement of the licensing authority.

6.3 The licensing authority shall interpret whether any such change is material or not, and whether a review of the licence is required as a result.

7. **Contributions to the Licensing Authority**:

7.1 The licensee shall pay the licensing Authority the costs incurred by the licensing authority of monitoring the discharge, subject to the following scale of fees;

Low risk, 2 visits	€238
Medium risk 3	€357
High Risk, 4 visits	€476
Additional Visits	€119

7.2 The Licensing Authority shall carry out a review of the previous year's inspections and monitoring results, coupled with the Licensee's Annual report, (4.1, above), in order to determine the expected level of risk, (and number of planned inspections), for the forthcoming year. A mid-year review may also be carried out to re-assess the risk & adjust the monitoring frequency accordingly.

7.3 The Licensee shall pay the Licensing Authority such additional fees, as the Licensing Authority considers necessary for the carrying out of any confirmatory or specialist testing during the life of the licence.

Joe Ferry

Joe Ferry (Dr.),
Executive Scientist

Dated this 13th January 2016

Appeals

You are advised that a person to whom a licence has been granted may appeal, under Section 8 of the Local Government (Water Pollution) Act, 1977, as substituted by Section 6 of the Local Government (Water Pollution) Act, 1990, to an Bord Pleanala in relation to the grant. Such appeal should be made in writing, within one month from the date of grant of the licence stating the subject matter of the appeal and the grounds of the appeal. Any appeal to An Bord Pleanala must be accompanied by a fee of €126.

COMHAIRLE CHONTAE DHUN NA NGALL
DONEGAL COUNTY COUNCIL
CENTRAL LABORATORY,
THE KUBE, MAGHERANAN.
LETTERKENNY, CO. DONEGAL.
Tel (074) 91 22787

THE LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977
THE LOCAL GOVERNMENT (WATER POLLUTION) (AMMENDMENT) ACT, 1990

Local Authority: **Donegal County Council**

Notice of Decision on Review of Licence for discharge of trade effluent to waters for:

Ms Marie McDevitt,
Director,
Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Co Donegal.

Reference Number in Register: **Lwat 41.**

TAKE NOTICE in accordance with Article 15 of the Local Government (Water Pollution) Regulations, 1978, that on the date hereof the Donegal County Council has completed a review, under Section 7, of the Local Government (Water Pollution) Act, 1977, as amended by Section 5 of the Local Government (Water Pollution) Act, 1990, of the licence granted to you for discharge of trade effluent to the receiving waters of Durnesh Lake and now gives notice on its decision on the review as follows:

(1)Conditions amended:-

Condition No 1 is amended to read:-

1. General layout and Operations:

1.1 This licence shall be in respect of the discharge of trade effluent arising in that part of the licensee's lands known as the North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal. Only quarry water arising in the North Quarry shall be discharged as effluent.
1.2 The licensee shall install and maintain adequate treatment facilities to ensure that the effluent discharging from the premises of The North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal, complies with the effluent discharge licence conditions at all times.
1.3 The North Quarry site shall be laid out, operated and maintained in such a manner as to prevent the discharge of any polluting matter to the receiving waters other than via the wastewater treatment system.

1.4 All clean unpolluted waters upstream from the discharge location must be directed to the receiving waters of Lake Durnesh, by a route free from pollution.

1.5 No domestic sewage or hydrocarbon oils shall be discharged with or allowed to mix with the effluent arising in the North Quarry.

1.6 The licensee shall ensure that all contaminated run off from the site goes directly to a sealed treatment area/ lagoons/ settlement ponds without causing pollution of any waterway and is retained there until it is treated and from there discharges to the stream under licence conditions. Drainage channels should be constructed sufficiently deep enough to facilitate high flows during heavy rainfall.

1.7 The licensee shall ensure that there is no structural cracks/defects in the settlement ponds/ lagoons, that they are appropriately lined using stiff clay/liner, and that they are of such a size as to store all effluent, without leaks or overflow, until the effluent is discharged to the river in compliance with the effluent discharge licence.

1.8 The settlement lagoons/ponds shall be arranged so as to work in series. A suitable maintenance strategy is required in order to maintain operating efficiency & minimise the disruption to the settlement process during dredging procedures.

1.9 The licensee shall not dispose of any sludge arising in the settlement ponds or lagoons or other areas of the North Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal other than in accordance with the Waste Management act 1996. Records of all waste disposal operations must be maintained and made available to persons authorised under the Waste Management Act 1996.

1.10 In the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence, the licensee shall make good all damage resulting from such pollution, including, if necessary:

(a) the replacement of fish stocks;
(b) the restoration of spawning grounds;
(c) the replacement of shellfish stock (Freshwater Pearl Mussel);
(d) the restoration of shellfish (Freshwater Pearl Mussel) habitat.
(e) any restoration of habitat or replacement of fish/shellfish stocks should only occur following detailed consultations with and the agreement of the National Parks & Wildlife Service (NPWS).
(f) the removal of pollutant from waters;
(g) the modification of it's discharge regime to prevent recurrence;
(h) such other measures as may by directed by the Local Authority.

1.11 In the event that any observations are made by persons authorised under the Water Pollution Act 1977/90 on the quality or appearance of the surface water discharge indicating that contamination has taken place, the licensee shall:

(a) carry out an immediate investigation to identify and isolate the source of contamination,
(b) put in place measures to prevent further contamination and to minimise the effects of any contamination on the environment, and
(c) notify the Local Authority, the Inland Fisheries Ireland (Ballyshannon) and the National Parks & Wildlife Service immediately.

1.12 The licensee must submit a site environmental response plan within one month of receipt of this licence, which should outline response plans for use in the event of pollution of the receiving waters arising from the licensee's activities, whether due to

accidental discharge or discharge other than in accordance with the terms and conditions of this licence.

1.13 The licensee shall ensure that vehicles used for transport of materials from the premises, all roads/tracks within the site and all processing/handling equipment are maintained in a dampened condition during dry weather to prevent dust blow. All run-off from such spraying and dampening processes must be directed to the treatment (settling lagoon) system. If dust or liquid deposits occur on the public roads, drains or hedges, as a result of the operations on the site, and such deposits enter into the local drainage system, contravening the limits set in this licence, the licensee shall clean up all such deposits immediately.

1.14 All vehicles leaving the quarry site must pass through a wheelwash facility and water sprinkling system, which will ensure the damping down of the vehicle and its contents in order to prevent dust blow. The wheel wash system should be routinely cleaned & maintained so as to ensure that no sediment is transported onto access roads, which would give rise to dust in dry weather conditions.

1.15 The wheel wash facility must be designed in such a way as to ensure that the vehicle does not come into contact with settled material, (silt). The vehicle must drive over a grid/ cattle grid type structure, allowing all contaminated waters to fall into a collection sump underneath the grid. The sump should be of such a size, as to allow the contaminated waters time to settle. The effluent from this wheel wash sump shall be directed to the treatment system, (lagoons), before discharging through the licenced discharge point, under licence conditions to the receiving waters of Lake Durnesh.

1.16 All oil/petrol/ diesel storage tanks shall, as a minimum, be bunded to a volume of not less than 110% of the capacity of the largest tank or drum within the bunded area. Bund tanks must not have valve arrangements for surface water disposal.

1.17 Oil interceptors shall be provided, were necessary, to ensure that the effluent discharging to the river meets licence standards.

1.18 Discharges from lorry/car washing facilities shall not enter the main oil interceptor system as detergents in such discharges can emulsify oil trapped in the interceptor and allow it to escape. Lorry/car wash effluent shall be directed to the treatment system, (lagoons) and shall not be discharged directly to any nearby watercourse.

Condition No 2 is amended to read:-

2. Effluent Volume and Characteristics :

2.1 The total volume of treated effluent to be discharged shall not exceed the following limits :

Parameter	**Units**	**Limit(s)**
Volumetric flow per day (24 hours)	M^3	350
Volumetric flow per hour	M^3	14
Volumetric flow per minute	M^3	0.25
Maximum Volumetric flow in 24 hours in Winter months	M^3	700

2.2 Oils and grease shall not be present in effluent in such quantities as to :
(a) form visible films on the surface of the water;
(b) form coatings on the river bed, benthic biota or food resources;
(c) cause deleterious effects on aquatic life;

2.3 Effluent as discharged shall comply with the quality standards set out hereunder in respect of the following parameters :

Parameter	**Units**	**Limit(s)**
pH	pH units	6 - 9
Suspended Solids	mg/litre	20
Fats/oils/greases	Visual	Shall not be present in the effluent in such quantities as to form visible films on the surface of the discharging effluent.

Condition No. 3 is amended to read:-

3. Monitoring Regime :

3.1 An accessible safe sampling points shall be provided, which is representative of the final
Discharge.

3.2 The licensee shall commission an independent accredited laboratory to analyse samples of the discharge on a quarterly basis. The samples shall be taken at a time when the quarry is in operation. The samples shall be taken so as to be representative of the effluent discharge.

3.3 The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.4 The licensee shall install and maintain an automatic flow recorder and report as in section 4 below. The licensee shall install and automatic flow related sampler if deemed necessary by persons authorised under the Water Pollution Act 1977/90, at some time in the future.

3.5 The licencee shall conduct a visual inspection of the discharge on a daily basis.

3.6 The licensee shall commission an independent accredited laboratory, once per year, to analyse samples of the receiving water into which the effluent discharges at a representative location upstream and downstream from the discharge. The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.7 The operating sediment ponds and oil interceptors must be inspected at least monthly and more frequently during heavy rainfall. A record must be kept of these inspections noting the condition of the settlement ponds, appearance of the effluent and weather conditions. This record must be available for inspection by persons authorised under the Water Pollution Act 1977/90 & reported as per 4.1.

3.8 Regular checks for embankment failure, such as seeps or erosion, must be made and a record must be kept of these checks.

3.9 The depth of sediment in the sedimentation ponds must be monitored at sufficient intervals to plan for sediment removal at minimum pond flow, but before the average sediment depth reaches 50% of the pond depth.

3.10 When new ponds are created, validation checks must be carried out when construction work is completed to ensure that the ponds are sealed and operate effectively.

Condition No. 7 is amended to read:-

7. Contributions to the Licensing Authority:

7.1 The licensee shall pay the licensing Authority the costs incurred by the licensing authority of monitoring the discharge, subject to the following scale of fees;

Low risk, 2 visits	€238
Medium risk 3	€357
High Risk, 4 visits	€476
Additional Visits	€119

7.2 The Licensing Authority shall carry out a review of the previous year's inspections and monitoring results, coupled with the Licensee's Annual report, (4.1, above), in order to determine the expected level of risk, (and number of planned inspections), for the forthcoming year. A mid-year review may also be carried out to re-assess the risk & adjust the monitoring frequency accordingly.

7.3 The Licensee shall pay the Licensing Authority such additional fees, as the Licensing Authority considers necessary for the carrying out of any confirmatory or specialist testing during the life of the licence.

(2)Conditions deleted

None

(3) Additional conditions.

4. Reporting

4.1 The Licencee shall forward to Donegal County Council an Annual Report giving the results of analysis, as per the following table;

Parameter	**Test Frequency**	**Report**
pH and Suspended Solids of the discharge	4 per year	Annual
pH, Suspended Solids of the receiving water, upstream and downstream of the discharge.	Once per year	Annual
Effluent Visual check	Daily	Annual
Settlement Pond and oil interceptor inspections	Monthly	Annual
Volume	Daily	Annual

4.2 The Annual report shall be forwarded to Donegal County Council, by the end January each year giving the previous year's results on an Excel spreadsheet to dischargeresults@donegalcoco.ie

4.3 The Annual report shall include an assessment of compliance of in-house monitoring results with licence conditions, explanations for breaches and detailed corrective/preventive action plans designed to address the root causes of non-compliances/breaches in the coming year.

AND FURTHER TAKE NOTICE

that a person to whom a licence has been granted may appeal, under Section 8 of the Local Government (Water Pollution) Act, 1977, as substituted by Section 6 of the Local Government (Water Pollution) Act, 1990, to an Bord Pleanala in relation to the grant. Such appeal should be made in writing, within one month from the date of grant of the licence stating the subject matter of the appeal and the grounds of the appeal. Any appeal to An Bord Pleanala must be accompanied by a fee of €126.

Joc Ferry

Joc Ferry (Dr.)
Executive Scientist.

DATED THIS 13th **DAY OF** January **,2016.**

APPENDIX 2-3

Comhairle Contae
Dhún na nGall
Donegal County Council

Ms Marie McDevitt,
Director,
Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Donegal,
Co. Donegal.

25th January 2016

c.c. Patrick O'Donnell, Earth Science Partnership Ire. Ltd., Tonranny, Westport, Co. Mayo.

Re: P. McCaffrey & Sons Ltd. - licence review.

Enclosed reviewed discharge licences for P McCaffrey & Sons Ltd. reference numbers Lwat41 and Lwat48.

Yours sincerely,

S. Mc Menamin

Shirley McMenamin,
Senior Executive Technician.

Comhairle Contae
Dhún na nGall
Donegal County Council

LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977

LOCAL GOVERNMENT (WATER POLLUTION) (AMENDMENT) ACT, 1990.

Licence to discharge trade effluent to waters

LOCAL AUTHORITY **DONEGAL COUNTY COUNCIL**

Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Co Donegal.

Reference Number in Register: **Lwat 48.**

Donegal County Council in exercise of the powers conferred on it by the Local Government (Water Pollution) Act, 1977 and the Local Government (Water Pollution) (Amendment) Act, 1990 hereby grant an effluent discharge licence to discharge effluent from the premises of Patrick McCaffrey & Sons Limited, at Ballymagroarty Irish, Ballymagroarty Scotch, Ballintra, Co Donegal, known as the South Quarry to the receiving waters of Durnesh Lake subject to the following conditions:

1. General layout and Operations:

1.1 This licence shall be in respect of the discharge of trade effluent arising in that part of the licensee's lands known as the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal. Only quarry water arising in the South Quarry shall be discharged as effluent.

1.2 The licensee shall install and maintain adequate treatment facilities to ensure that the effluent discharging from the premises of the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal, complies with the effluent discharge licence conditions at all times.

1.3 The South Quarry site shall be laid out, operated and maintained in such a manner as to prevent the discharge of any polluting matter to the receiving waters other than via the wastewater treatment system.

1.4 All clean unpolluted waters upstream from the discharge location must be directed to the receiving waters of Lake Durnesh, by a route free from pollution.

1.5 No domestic sewage or hydrocarbon oils shall be discharged with or allowed to mix with the effluent arising in the South Quarry.

1.6 The licensee shall ensure that all contaminated run off from the site goes directly to a sealed treatment area/ lagoons/ settlement ponds without causing pollution of any waterway and is retained there until it is treated and from there discharges to the stream under licence conditions.

Drainage channels should be constructed sufficiently deep enough to facilitate high flows during heavy rainfall.

1.7 The licensee shall ensure that there is no structural cracks/defects in the settlement ponds/ lagoons, that they are appropriately lined using stiff clay/liner, and that they are of such a size as to store all effluent, without leaks or overflow, until the effluent is discharged to the river in compliance with the effluent discharge licence.

1.8 The settlement lagoons/ponds shall be arranged so as to work in series. A suitable maintenance strategy is required in order to maintain operating efficiency & minimise the disruption to the settlement process during dredging procedures.

1.9 The licensee shall not dispose of any sludge arising in the settlement ponds or lagoons or other areas of the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal other than in accordance with the Waste Management act 1996. Records of all waste disposal operations must be maintained and made available to persons authorised under the Waste Management Act 1996.

1.10 In the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence, the licensee shall make good all damage resulting from such pollution, including, if necessary:

(a) the replacement of fish stocks;
(b) the restoration of spawning grounds;
(c) the replacement of shellfish stock (Freshwater Pearl Mussel);
(d) the restoration of shellfish (Freshwater Pearl Mussel) habitat.
(e) any restoration of habitat or replacement of fish/shellfish stocks should only occur following detailed consultations with and the agreement of the National Parks & Wildlife Service (NPWS).
(f) the removal of pollutant from waters;
(g) the modification of it's discharge regime to prevent recurrence;
(h) such other measures as may by directed by the Local Authority.

1.11 In the event that any observations are made by persons authorised under the Water Pollution Act 1977/90 on the quality or appearance of the surface water discharge indicating that contamination has taken place, the licensee shall:

(a) carry out an immediate investigation to identify and isolate the source of contamination,
(b) put in place measures to prevent further contamination and to minimise the effects of any contamination on the environment, and
(c) notify the Local Authority, the Northern Regional Fisheries Board and the National Parks & Wildlife Service immediately.

1.12 The licensee must submit a site environmental response plan within one month of receipt of this licence, which should outline response plans for use in the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence.

1.13 The licensee shall ensure that vehicles used for transport of materials from the premises, all roads/tracks within the site and all processing/handling equipment are maintained in a dampened condition during dry weather to prevent dust blow. All run-off from such spraying and dampening processes must be directed to the treatment (settling lagoon) system. If dust or liquid deposits occur on the public roads, drains or hedges, as a result of the operations on the site, and such deposits enter into the local drainage system, contravening the limits set in this licence, the licensee shall clean up all such deposits immediately.

1.14 All vehicles leaving the quarry site must pass through a wheelwash facility and water sprinkling system, which will ensure the damping down of the vehicle and its contents in order to prevent dust blow. The wheel wash system should be routinely cleaned & maintained so as to ensure that

no sediment is transported onto access roads, which would give rise to dust in dry weather conditions.

1.15 The wheel wash facility must be designed in such a way as to ensure that the vehicle does not come into contact with settled material, (silt). The vehicle must drive over a grid/ cattle grid type structure, allowing all contaminated waters to fall into a collection sump underneath the grid. The sump should be of such a size, as to allow the contaminated waters time to settle. The effluent from this wheel wash sump shall be directed to the treatment system, (lagoons), before discharging through the licenced discharge point, under licence conditions to the receiving waters of Lake Durnesh.

1.16 All oil/petrol/ diesel storage tanks shall, as a minimum, be bunded to a volume of not less than 110% of the capacity of the largest tank or drum within the bunded area. Bund tanks must not have valve arrangements for surface water disposal.

1.17 Oil interceptors shall be provided, were necessary, to ensure that the effluent discharging to the river meets licence standards.

1.18 Discharges from lorry/car washing facilities shall not enter the main oil interceptor system as detergents in such discharges can emulsify oil trapped in the interceptor and allow it to escape. Lorry/car wash effluent shall be directed to the treatment system, (lagoons) and shall not be discharged directly to any nearby watercourse.

2. **Effluent Volume and Characteristics** :

2.1 The total volume of treated effluent to be discharged shall not exceed the following limits :

Parameter	**Units**	**Limit(s)**
Volumetric flow per day (24 hours)	M^3	1000
Volumetric flow per hour	M^3	42
Volumetric flow per minute	M^3	7
Maximum Volumetric flow in 24 hours in Winter months	M^3	1400

2.2 Oils and grease shall not be present in effluent in such quantities as to :
(a) form visible films on the surface of the water;
(b) form coatings on the river bed, benthic biota or food resources;
(c) cause deleterious effects on aquatic life;

2.3 Effluent as discharged shall comply with the quality standards set out hereunder in respect of the following parameters :

Parameter	**Units**	**Limit(s)**
pH	pH units	6 – 9
Suspended Solids	mg/litre	20
Fats/oils/greases	Visual	Shall not be present in the effluent in such quantities as to form visible films on the surface of the discharging effluent.

3. **Monitoring Regime** :

3.1 An accessible safe sampling points shall be provided, which is representative of the final

Discharge.

3.2 The licensee shall commission an independent accredited laboratory to analyse samples of the discharge on a quarterly basis. The samples shall be taken at a time when the quarry is in operation. The samples shall be taken so as to be representative of the effluent discharge.

3.3 The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.4 The licensee shall install and maintain an automatic flow recorder and report as in section 4 below. The licensee shall install and automatic flow related sampler if deemed necessary by persons authorised under the Water Pollution Act 1977/90, at some time in the future.

3.5 The licencee shall conduct a visual inspection of the discharge on a daily basis.

3.6 The licensee shall commission an independent accredited laboratory to analyse samples of the receiving water into which the effluent discharges at a representative location upstream and downstream from the discharge. The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.7 The operating sediment ponds and oil interceptors must be inspected at least monthly and more frequently during heavy rainfall. A record must be kept of these inspections noting the condition of the settlement ponds, appearance of the effluent and weather conditions. This record must be available for inspection by persons authorised under the Water Pollution Act 1977/90 & reported as per 4.1.

3.8 Regular checks for embankment failure, such as seeps or erosion, must be made and a record must be kept of these checks.

3.9 The depth of sediment in the sedimentation ponds must be monitored at sufficient intervals to plan for sediment removal at minimum pond flow, but before the average sediment depth reaches 50% of the pond depth.

3.10 When new ponds are created, validation checks must be carried out when construction work is completed to ensure that the ponds are sealed and operate effectively.

4. Reporting

4.1 The Licencee shall forward to Donegal County Council an Annual Report giving the results of analysis, as per the following table;

Parameter	Test Frequency	Report
pH and Suspended Solids of the discharge	4 per year	Annual
pH, Suspended Solids of the receiving water upstream and downstream from the discharge.	Once per year	Annual
Effluent Visual check	Daily	Annual
Settlement Pond and oil interceptor inspections	Monthly	Annual
Volume	Daily	Annual

4.2 The Annual report shall be forwarded to Donegal County Council, by the end January each year giving the previous year's results on an Excel spreadsheet to dischargeresults@donegalcoco.ie

4.3 The Annual report shall include an assessment of compliance of in-house monitoring results with licence conditions, explanations for breaches and detailed corrective/preventive action plans designed to address the root causes of non-compliances/breaches in the coming year.

5. Access by Authorised Personnel :

5.1 Details of emergency contact personnel, including addresses and telephone numbers, shall be forwarded to the licensing authority within one month of the date of grant of this licence. At least one such person shall be available for contact at all reasonable times, having due authorisation from the licensee to expediate emergency measures as may be required.

5.2 Authorised Officers of the Licensing Authority, or its agents, or any person authorised under section 28 of the Local Government (Water Pollution) Act 1977 as amended by section 19 of the

Local Government (Water Pollution) (Amendment) Act, 1990 shall have access to the licensees site at all times.

6. **Change of use of Development**:

6.1 The licensee shall notify the Licensing Authority of any proposed change in the operation of the quarry or plant that would cause, or be likely to cause, a material alteration in the nature, or increase in the volume of effluent discharged.

6.2 No changes in relation to the discharge (flow rates, effluent concentrations) shall take place without prior written agreement of the licensing authority.

6.3 The licensing authority shall interpret whether any such change is material or not, and whether a review of the licence is required as a result.

7. **Contributions to the Licensing Authority**:

7.1 The licensee shall pay the licensing Authority the costs incurred by the licensing authority of monitoring the discharge, subject to the following scale of fees;

Low risk, 2 visits	€238
Medium risk 3	€357
High Risk, 4 visits	€476
Additional Visits	€119

7.2 The Licensing Authority shall carry out a review of the previous year's inspections and monitoring results, coupled with the Licensee's Annual report, (4.1, above), in order to determine the expected level of risk, (and number of planned inspections), for the forthcoming year. A mid-year review may also be carried out to re-assess the risk & adjust the monitoring frequency accordingly.

7.3 The Licensee shall pay the Licensing Authority such additional fees, as the Licensing Authority considers necessary for the carrying out of any confirmatory or specialist testing during the life of the licence.

Joe Ferry

Joe Ferry (Dr.),
Executive Scientist

Dated this 13th January 2016

Appeals

You are advised that a person to whom a licence has been granted may appeal, under Section 8 of the Local Government (Water Pollution) Act, 1977, as substituted by Section 6 of the Local Government (Water Pollution) Act, 1990, to an Bord Pleanala in relation to the grant. Such appeal should be made in writing, within one month from the date of grant of the licence stating the subject matter of the appeal and the grounds of the appeal. Any appeal to An Bord Pleanala must be accompanied by a fee of €126.

COMHAIRLE CHONTAE DHUN NA NGALL
DONEGAL COUNTY COUNCIL
CENTRAL LABORATORY,
THE KUBE, MAGHERANAN,
LETTERKENNY, CO. DONEGAL.
Tel (074) 91 22787

THE LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977
THE LOCAL GOVERNMENT (WATER POLLUTION) (AMMENDMENT) ACT, 1990

Local Authority: **Donegal County Council**

Notice of Decision on Review of Licence for discharge of trade effluent to waters for:

Ms Marie McDevitt,
Director,
Patrick McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Glasbolie,
Ballintra,
Co Donegal.

Reference Number in Register: **Lwat 48.**

TAKE NOTICE in accordance with Article 15 of the Local Government (Water Pollution) Regulations, 1978, that on the date hereof the Donegal County Council has completed a review, under Section 7, of the Local Government (Water Pollution) Act, 1977, as amended by Section 5 of the Local Government (Water Pollution) Act, 1990, of the licence granted to you for discharge of trade effluent to the receiving waters of Durnesh Lake and now gives notice on its decision on the review as follows:

(1)Conditions amended:-

Condition No 1 is amended to read:-

1. General layout and Operations:

1.1 This licence shall be in respect of the discharge of trade effluent arising in that part of the licensee's lands known as the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal. Only quarry water arising in the South Quarry shall be discharged as effluent.
1.2 The licensee shall install and maintain adequate treatment facilities to ensure that the effluent discharging from the premises of the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal, complies with the effluent discharge licence conditions at all times.
1.3 The South Quarry site shall be laid out, operated and maintained in such a manner as to prevent the discharge of any polluting matter to the receiving waters other than via the wastewater treatment system.

1.4 All clean unpolluted waters upstream from the discharge location must be directed to the receiving waters of Lake Durnesh, by a route free from pollution.

1.5 No domestic sewage or hydrocarbon oils shall be discharged with or allowed to mix with the effluent arising in the South Quarry.

1.6 The licensee shall ensure that all contaminated run off from the site goes directly to a sealed treatment area/ lagoons/ settlement ponds without causing pollution of any waterway and is retained there until it is treated and from there discharges to the stream under licence conditions. Drainage channels should be constructed sufficiently deep enough to facilitate high flows during heavy rainfall.

1.7 The licensee shall ensure that there is no structural cracks/defects in the settlement ponds/ lagoons, that they are appropriately lined using stiff clay/liner, and that they are of such a size as to store all effluent, without leaks or overflow, until the effluent is discharged to the river in compliance with the effluent discharge licence.

1.8 The settlement lagoons/ponds shall be arranged so as to work in series. A suitable maintenance strategy is required in order to maintain operating efficiency & minimise the disruption to the settlement process during dredging procedures.

1.9 The licensee shall not dispose of any sludge arising in the settlement ponds or lagoons or other areas of the South Quarry, owned and operated by Patrick McCaffrey & Sons Ltd. Co. Donegal other than in accordance with the Waste Management act 1996. Records of all waste disposal operations must be maintained and made available to persons authorised under the Waste Management Act 1996.

1.10 In the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental discharge or discharge other than in accordance with the terms and conditions of this licence, the licensee shall make good all damage resulting from such pollution, including, if necessary:

(a) the replacement of fish stocks;
(b) the restoration of spawning grounds;
(c) the replacement of shellfish stock (Freshwater Pearl Mussel);
(d) the restoration of shellfish (Freshwater Pearl Mussel) habitat.
(e) any restoration of habitat or replacement of fish/shellfish stocks should only occur following detailed consultations with and the agreement of the National Parks & Wildlife Service (NPWS).
(f) the removal of pollutant from waters;
(g) the modification of it's discharge regime to prevent recurrence;
(h) such other measures as may by directed by the Local Authority.

1.11 In the event that any observations are made by persons authorised under the Water Pollution Act 1977/90 on the quality or appearance of the surface water discharge indicating that contamination has taken place, the licensee shall:

(a) carry out an immediate investigation to identify and isolate the source of contamination,
(b) put in place measures to prevent further contamination and to minimise the effects of any contamination on the environment, and
(c) notify the Local Authority, the Northern Regional Fisheries Board and the National Parks & Wildlife Service immediately.

1.12 The licensee must submit a site environmental response plan within one month of receipt of this licence, which should outline response plans for use in the event of pollution of the receiving waters arising from the licensee's activities, whether due to accidental

discharge or discharge other than in accordance with the terms and conditions of this licence.

1.13 The licensee shall ensure that vehicles used for transport of materials from the premises, all roads/tracks within the site and all processing/handling equipment are maintained in a dampened condition during dry weather to prevent dust blow. All run-off from such spraying and dampening processes must be directed to the treatment (settling lagoon) system. If dust or liquid deposits occur on the public roads, drains or hedges, as a result of the operations on the site, and such deposits enter into the local drainage system, contravening the limits set in this licence, the licensee shall clean up all such deposits immediately.

1.14 All vehicles leaving the quarry site must pass through a wheelwash facility and water sprinkling system, which will ensure the damping down of the vehicle and its contents in order to prevent dust blow. The wheel wash system should be routinely cleaned & maintained so as to ensure that no sediment is transported onto access roads, which would give rise to dust in dry weather conditions.

1.15 The wheel wash facility must be designed in such a way as to ensure that the vehicle does not come into contact with settled material, (silt). The vehicle must drive over a grid/ cattle grid type structure, allowing all contaminated waters to fall into a collection sump underneath the grid. The sump should be of such a size, as to allow the contaminated waters time to settle. The effluent from this wheel wash sump shall be directed to the treatment system, (lagoons), before discharging through the licenced discharge point, under licence conditions to the receiving waters of Lake Durnesh.

1.16 All oil/petrol/ diesel storage tanks shall, as a minimum, be bunded to a volume of not less than 110% of the capacity of the largest tank or drum within the bunded area. Bund tanks must not have valve arrangements for surface water disposal.

1.17 Oil interceptors shall be provided, were necessary, to ensure that the effluent discharging to the river meets licence standards.

1.18 Discharges from lorry/car washing facilities shall not enter the main oil interceptor system as detergents in such discharges can emulsify oil trapped in the interceptor and allow it to escape. Lorry/car wash effluent shall be directed to the treatment system, (lagoons) and shall not be discharged directly to any nearby watercourse.

Condition No 2 is amended to read:-

2. Effluent Volume and Characteristics :

2.1 The total volume of treated effluent to be discharged shall not exceed the following limits :

Parameter	**Units**	**Limit(s)**
Volumetric flow per day (24 hours)	M^3	1000
Volumetric flow per hour	M^3	42
Volumetric flow per minute	M^3	7
Maximum Volumetric flow in 24 hours in Winter months	M^3	1400

2.2 Oils and grease shall not be present in effluent in such quantities as to :
(a) form visible films on the surface of the water;
(b) form coatings on the river bed, benthic biota or food resources;
(c) cause deleterious effects on aquatic life;

2.3 Effluent as discharged shall comply with the quality standards set out hereunder in respect of the following parameters :

Parameter	**Units**	**Limit(s)**
pH	pH units	6 – 9
Suspended Solids	mg/litre	20
Fats/oils/greases	Visual	Shall not be present in the effluent in such quantities as to form visible films on the surface of the discharging effluent.

Condition No. 3 is amended to read:-

3. Monitoring Regime :

3.1 An accessible safe sampling points shall be provided, which is representative of the final
Discharge.

3.2 The licensee shall commission an independent accredited laboratory to analyse samples of the discharge on a quarterly basis. The samples shall be taken at a time when the quarry is in operation. The samples shall be taken so as to be representative of the effluent discharge.

3.3 The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.4 The licensee shall install and maintain an automatic flow recorder and report as in section 4 below. The licensee shall install and automatic flow related sampler if deemed necessary by persons authorised under the Water Pollution Act 1977/90, at some time in the future.

3.5 The licencee shall conduct a visual inspection of the discharge on a daily basis.

3.6 The licensee shall commission an independent accredited laboratory to analyse samples of the receiving water into which the effluent discharges at a representative location upstream and downstream from the discharge. The samples shall be analysed for pH and Suspended Solids and report as in section 4 below.

3.7 The operating sediment ponds and oil interceptors must be inspected at least monthly and more frequently during heavy rainfall. A record must be kept of these inspections noting the condition of the settlement ponds, appearance of the effluent and weather conditions. This record must be available for inspection by persons authorised under the Water Pollution Act 1977/90 & reported as per 4.1.

3.8 Regular checks for embankment failure, such as seeps or erosion, must be made and a record must be kept of these checks.

3.9 The depth of sediment in the sedimentation ponds must be monitored at sufficient intervals to plan for sediment removal at minimum pond flow, but before the average sediment depth reaches 50% of the pond depth.

3.10 When new ponds are created, validation checks must be carried out when construction work is completed to ensure that the ponds are sealed and operate effectively.

Condition No. 7 is amended to read:-

7. Contributions to the Licensing Authority:

7.1 The licensee shall pay the licensing Authority the costs incurred by the licensing authority of monitoring the discharge, subject to the following scale of fees;

Low risk, 2 visits	€238
Medium risk 3	€357
High Risk, 4 visits	€476
Additional Visits	€119

7.2 The Licensing Authority shall carry out a review of the previous year's inspections and monitoring results, coupled with the Licensee's Annual report, (4.1, above), in order to determine the expected level of risk, (and number of planned inspections), for the forthcoming year. A mid-year review may also be carried out to re-assess the risk & adjust the monitoring frequency accordingly.

7.3 The Licensee shall pay the Licensing Authority such additional fees, as the Licensing Authority considers necessary for the carrying out of any confirmatory or specialist testing during the life of the licence.

(2)Conditions deleted

None

(3) Additional conditions.

4. Reporting

4.1 The Licencee shall forward to Donegal County Council an Annual Report giving the results of analysis, as per the following table;

Parameter	**Test Frequency**	**Report**
pH and Suspended Solids of the discharge	4 per year	Annual
pH, Suspended Solids of the receiving water upstream and downstream from the discharge.	Once per year	Annual
Effluent Visual check	Daily	Annual
Settlement Pond and oil interceptor inspections	Monthly	Annual
Volume	Daily	Annual

4.2 The Annual report shall be forwarded to Donegal County Council, by the end January each year giving the previous year's results on an Excel spreadsheet to dischargeresults@donegalcoco.ie

4.3 The Annual report shall include an assessment of compliance of in-house monitoring results with licence conditions, explanations for breaches and detailed corrective/preventive action plans designed to address the root causes of non-compliances/breaches in the coming year.

AND FURTHER TAKE NOTICE

that a person to whom a licence has been granted may appeal, under Section 8 of the Local Government (Water Pollution) Act, 1977, as substituted by Section 6 of the Local Government (Water Pollution) Act, 1990, to an Bord Pleanala in relation to the grant. Such appeal should be made in writing, within one month from the date of grant of the licence stating the subject matter of the appeal and the grounds of the appeal. Any appeal to An Bord Pleanala must be accompanied by a fee of €126.

Joe Ferry

Joe Ferry (Dr.)
Executive Scientist.

DATED THIS 13th **DAY OF** January **, 2016.**

APPENDIX 2-4

1845

05/1569

THE LOCAL GOVERNMENT (AIR POLLUTION) ACT 1987
THE LOCAL GOVERNMENT (LICENCING OF INDUSTRIAL PLANT) REGULATIONS, 1988.

SUBMITTED: Application has been received from P. Mc Caffrey & sons Ltd., for an Air Pollution Licence for their premises at Ballintra, Co. Donegal. A draft licence issued by Donegal County Council on the 22nd day of March, 2005, has been appealed to An Bord Pleanala.

RECOMMENDATION: That the Council adopts the direction of An Bord Pleanala and issues a licence to P. Mc Caffrey & sons Ltd.,subject to the attached conditions.

SENIOR EXECUTIVE CHEMIST.

ORDER: Recommendation approved. I order that the Council's decision on the licence application shall be in accordance with the recommendations of Mr Donal Casey, Senior Executive Chemist and that notice of that decision be given to the licencee and in accordance with the provisions of the Local Government Air Pollution Act 1987,(Licensing of Industrial Plant) Regulations, 1988.

DIRECTOR OF SERVICES.

DATED THIS 02 **day of** November **2005.**

Local Government (Air Pollution) Act 1987

Licence in relation to Industrial Plant.

P McCaffrey & Sons Ltd.,
Ballymagroarty Irish,
Ballintra,
Co. Donegal.

Ref No. APL 05/01.

The Donegal County Council in exercise of the powers conferred on it by the Air Pollution Act, 1987, hereby grant a revised licence in substitution for licence dated 22/03/05, ref. 05/01, for the operation of a Bitumen/Roadstone Coating plant, to P. Mc Caffrey & sons Ltd., for their site at Ballymagroarty Irish, Ballintra, subject to the following conditions:

1. Scope

1.1 This licence is issued to P. McCaffery and Sons Limited of Ballymagroarty Irish, Ballintra, County Donegal in respect of the facility described in the application and accompanying documentation submitted to the licensing authority and in respect of the operations of the said plant at the said address. 'Facility' includes the bitumen asphalt macadam plant and all associated activities.

1.2 The activity shall be controlled, operated and maintained and emissions shall take place as set out in this licence. Notwithstanding any other provision of this licence, emissions to the atmosphere arising from the licensed plant and process shall not give rise to environmental pollution, including public health nuisance. All programmes required to be carried out under the terms of this licence become part of this licence.

1.3 The licensee's premises shall be laid out, operated and maintained in such a manner as to prevent emissions to the atmosphere other than in accordance with this licence.

1.4 The licensee shall not carry out or commence without the prior written agreement of the licensing authority any alteration to, or reconstruction in respect of, the activity or any part thereof, or changes in materials or process that would, or would be likely to, result in a material change or increase in:

(a) the nature or quantity of any emission,

(b) the abatement/treatment of any emission, or

(c) the site management and control with adverse impact on emissions to air.

1.5 The licensing authority shall determine whether any change so notified would constitute a material change in the operation and shall reserve the right to request the licensee to apply for a new licence.

1.6 Authorised officers of the licensing authority or its agents or any other person authorised under the Air Pollution Act, 1987 shall have access to the licensee's premises at all reasonable times including, if necessary, times other than normal working hours for the purposes of carrying out their duties and ensuring compliance with the conditions of this licence.

1.7 For the purpose of limitation of emissions, the periods during which the licensed production facility shall conduct operations involving emissions to air shall be between 0700 hours to 1800 hours, Monday to Friday and 0700 hours and 1600 hours on Saturday. Trucks using the facility shall not enter or leave the site on any day before 0800 hours. The facility shall not operate on Sundays or Public holidays.

1.8 This licence is for the purpose of licensing under the Air Pollution Act, 1987, the production of tar and bitumen and the manufacture of products containing them only, and nothing in this licence shall be construed as negating the licensee's statutory obligations or requirements under any other enactments or regulations.

Reason: To clarify the scope of this licence.

2. Management of the Activity

2.1 The licensee shall issue a copy of this licence to all relevant personnel whose duties relate to any condition of this licence.

2.2 The licensee shall establish written procedures to ensure the following:

(a) The plant and machinery, and particularly emissions abatement items of plant shall be operated in accordance with the manufacturers instructions or in accordance with the best practise methods developed during the commissioning programme.

(b) Best practicable means shall be used to treat aerial emissions from the process.

(c) Corrective action shall be taken should the specified requirements of this licence not be fulfilled. The responsibility and authority for initiating further investigation and corrective action in the event of material non-compliance with the conditions of the licence shall be clearly defined to the licensing authority within six months of the date of grant of this licence.

2.3 Personnel performing tasks associated with management of or monitoring of emissions arising at the facility shall be qualified on the basis of appropriate education, training or experience, as required. The licensee shall provide appropriate training for all personnel whose work could have a significant effect upon the environment.

2.4 The licensee shall ensure that a person in charge shall be available on site at all times when the activity is in operation. This person shall be available to meet with authorised personnel of the licensing authority at all reasonable times. The licensee shall identify in writing to the licensing authority the responsible persons within one month from the date of grant of this licence.

2.5 The licensee shall ensure that all operations on-site are carried out in a manner such that site emissions or odours do not result in significant impairment of or significant interference with amenities or the environment or nuisance beyond the site boundary.

2.6 Within two months from the date of grant of this licence, the licensee shall commission from a suitably qualified independent person, a report on machinery, equipment or other facilities used for the storage, treatment, production or transportation of dusty materials. The report shall identify those facilities that are not enclosed and shall make recommendations for enclosure. The recommendation of the report

shall be implemented within six months of instruction of the licensee to do so by the licensing authority.

2.7 During (dry) weather conditions which favour the dispersion of dust, the licensee shall ensure that dust from the movement of machinery and windblown dust on-site is controlled. A procedure for dust control shall be drawn up by the licensee and shall be submitted to the licensing authority within one month from the date of grant of this licence.

2.8 All fuel and bitumen tanks shall be impervious to the materials stored therein and the storage tanks shall be bunded to a volume of 110% of the largest tank.

2.9 The licensee shall install in a prominent location on the site a windsock or other wind direction indicator which shall be visible from the public roadway at the front of the site. The licensee shall maintain the windsock in good condition and shall replace the windsock if it fails to indicate clearly the direction of the wind.

Reason: To ensure that the facility is managed with due regard for the environment.

3. Notification

3.1 The licensee shall notify the licensing authority as soon as practicable after the occurrence of any of the following:-

(a) Any malfunction or breakdown of control equipment which is likely to lead to loss of control of abatement on site.

(b) Any incident giving rise to an emission liable to cause nuisance in the surrounding lands.

(c) Any emissions which do not comply with the requirements of this licence.

3.2 The licensee shall record any such incident as set out in condition number 3.1 above. This record shall include details of the circumstances giving rise to the incident and all actions taken to minimise the effect on the surrounding environment. Records made in accordance with this condition shall be forwarded to the licensing authority within 10 days of the end of the month during which the incidents occur.

3.3 The licensee shall notify the licensing authority immediately concerning any incident which might require off-site emergency response.

Reason: To provide for reporting of incidents on site and to ensure records of the activity are up to date.

4. Emissions to Atmosphere

4.1 The concentration limits for emissions to atmosphere specified in this licence shall be based on gas volumes under standard conditions of: Temperature 273 K, Pressure 101.3 kPa., dry gas, 17% oxygen for liquid and gas fuels.

4.2 The exhaust emissions shall not exceed the following limits:-

Parameter	Emission limit value (mg/Nm_3)
Sulphur Dioxide (SO_2)	500
Oxides of nitrogen (NO_x)(as NO_2)	450
Particulates	20

4.3 There shall be no other emissions to the atmosphere of environmental significance.

4.4 Activities on site shall not give rise to ambient air concentrations which exceed the following limits:-

Parameter	Ambient Concentration Limit ($\mu g/m^3$)	Averaging Period
Nitrogen dioxide	200	hourly average
Sulphur dioxide	350	hourly average, as 97.7 percentile
Carbon monoxide	10,000	8 hour average
Benzene	5	annual average
Toluene	300	hourly average, as 99 percentile
Xylenes	300	hourly average, as 99 percentile
Naphthalene	40	hourly average, as 99 percentile

4.5 The introduction of dilution air to achieve emission concentration limits is not permitted. Exhaust flow rates shall be consistent with efficient capture of emission and good management practices.

4.6 Activities on site shall not give rise to dust deposition values which exceed 180 mg/m^2 per day averaged over a 30 day period.

4.7 All abatement, control and monitoring equipment shall be calibrated and maintained when in use, in accordance with the recommendations of the supplier and in agreement with the licensing authority so that the quarterly monitoring accurately reflects the ongoing emissions.

4.8 The licensee shall prepare a programme, to the satisfaction of the licensing authority, for the identification and reduction of fugitive emissions to air. This programme shall be provided to and agreed with the licensing authority within three months of the commencement of operation of the facility and shall be repeated on an annual basis thereafter. At all times adequate measures must be taken to ensure suppression of dust arising from all aspects of the tar and bitumen preparation process. This programme as a minimum shall address the following:-

(a) All particulate generating areas, including aggregate piles, conveyors and elevators, loading locations, crushers, screens, bag house filter discharge, rotary drum drier/mixing tower emission point, vehicular traffic.

(b) All volatile emission points including bitumen storage tanks, mixing tower emissions, asphalt treatment/storage emission points.

4.9 Within one month from the date of grant of this licence, the licensee shall submit a report to the licensing authority detailing the management system for the dust filter operation and maintenance including the recording of filter checks and changes. The report shall be submitted to the licensing authority on a quarterly basis.

4.10 The licensee shall not use waste or recovered oil as a fuel without the prior written agreement of the licensing authority.

Reason: To provide for protection of the surrounding environment by limitation and monitoring of emissions.

5. Air Dispersion Modelling

5.1 The licensee shall employ a competent person to monitor emissions from the plant over a full working day and determine the maximum hourly emission rates of the following materials:

(a) Sulphur Dioxide (SO_2)

(b) Oxides of nitrogen (NO_x) (as NO_2)

(c) Particulates

(d) Benzene

(e) Xylene

(f) Toluene

(g) Naphthalene

5.2 The licensee shall employ a competent person to use a dispersion model to predict the impact on air quality within an area two kilometres of the site boundary. The impact shall be determined in relation to the materials listed in condition number 5.1 above. The predicted ground level concentrations of sulphur dioxides, nitrogen oxides, particulates and benzene shall be compared with the relevant air quality standards set out in the Air Quality Standards Regulations, 2002 (S.I. No. 2001 of 2002). The predicted increase in ground level concentrations of xylene, toluene and naphthalene shall be compared with the Danish EPA C-values.

5.3 The dispersion model used to comply with condition number 5.2 shall explicitly take account of the surrounding buildings, berms and piles of aggregate and the height of the stack in relation in relation to the surrounding site level. The study shall include an estimate of the height of the stack at its present location that is required to prevent building downwash of emissions.

5.4 A report on the monitoring results and air dispersion modelling shall be forwarded to the licensing authority with three months from the date of grant of this licence.

5.5 Within three months of receipt of the report by the licensing authority, the stack height shall be raised to that identified in the report as required to prevent building downwash of emissions.

Reason: To ensure that the plant and stack shall not significantly adversely impact on air quality.

6. Periodic Monitoring

6.1 All automatic/passive monitors shall be functioning at all times (except during maintenance or calibration) when the activity is being carried on unless alternative sampling or monitoring has been agreed with the licensing authority for a limited period. In the event of malfunction of any continuous/passive monitor, the licensee shall contact the licensing authority as soon as possible and alternative monitoring facilities shall be put in place. Prior written agreement for the use of alternative equipment shall be obtained from the licensing authority.

6.2 Monitoring equipment shall be operated and maintained as necessary so that monitoring accurately measures the relevant parameters of the emission or discharge.

6.3 The licensee shall employ a competent independent person to monitor periodically the exhaust emissions as follows:

Parameter	Monitoring Frequency
Air flow	Every three months
Temperature	Every three months
Sulphur Dioxide (SO_2)	Every three months
Oxides of nitrogen (NO_x) (as NO_2)	Every two months
Particulates	Continuous

6.4. Monitoring shall be carried out when maximum emissions to the atmosphere are occurring.

6.5 A report on the results of this monitoring shall be submitted to the licensing authority on a quarterly basis.

6.6 The frequency of monitoring may be reduced to six months after the first year of operation if all of the measured values comply with the emission limit value specified for NO_x in this licence.

6.7 The licensee shall provide safe and permanent access to any sampling/monitoring points on the emission stack, and safe access to any other sampling/monitoring point required under this licence by the licensing authority.

6.8 The frequency, methods and scope of monitoring as set out in this licence may be amended with the written agreement of the licensing authority following evaluation of test results.

Reason: To ensure compliance with the requirements of conditions of the licence by provision of a satisfactory system of measurement and monitoring of emissions

7. Continuous Monitoring

7.1 Within three months of the date of grant of this licence, the exhaust stack shall be fitted with a continuous dust monitor (with data logger) that records continuous dust concentrations as discharged to the atmosphere.

7.2 The dust monitor shall be fitted with an audible alarm system, set to indicate an alarm if the dust concentration in the stack gases exceeds 20 mg/Nm^3.

7.3 The output of the dust monitor shall be recorded and show the average dust concentration in the exhaust gases for each hour and the maximum dust concentration within the hour.

7.4 The continuous monitor shall be calibrated at six monthly intervals and the results shall be submitted to the licensing authority on request.

7.5 The maximum dust concentration shall be calculated as the highest five minute average dust concentration recorded within the previous hour.

7.6 In the event of dust levels exceeding $20mg/m^3$ in the exhaust stack emissions, the operation of the dry bag filter shall be investigated. If it is found that the dust collection system has malfunctioned, plant operation shall cease until such time as the dust collection system is repaired.

Reason: To ensure that dust emissions are minimised.

8. Dust Deposition Monitoring

8.1 The licensee shall maintain and operate five Bergerhoff dust deposit gauges around the site boundary at locations to be agreed by the licensing authority. The dust gauges shall be operated in accordance with German VDI Method 2119 part 2:1972. Results of measurements from these gauges shall be sent to the licensing authority on a monthly basis.

8.2 Dust deposition shall not exceed 180 $mg/m^2/day$ averaged over 30 days, at any of the locations.

Reason: To ensure compliance with the requirements of conditions of the licence by provision of a satisfactory system of measurement and monitoring of dust deposition.

9. Noise Control

9.1 The licensee shall carry out a noise survey of the site operations annually. The survey programme shall be undertaken in accordance with the methodology specified in the 'Environmental Noise Survey Guidance Document' as published by the Environmental Protection Agency. The licensee shall consult with the licensing authority on the timing of the survey. A record of the survey results shall be available for inspection by any authorised persons of the licensing authority, at all reasonable times and a summary report of this record shall be submitted to the licensing authority on an annual basis.

9.2 Activities associated with the asphalt/macadam plant shall not give rise to noise levels off-site, at noise sensitive locations which exceed the following sound pressure limits (Equivalent continuous sound level Leq, 15 minutes) subject to condition number 3 of this licence:

Daytime: 55 dB(A),

Night-time: 45 dB(A).

9.3 There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location.

Reason: To ensure that noise emissions are minimised.

10. Recording and reporting to the licensing authority

10.1 The licensee shall record all sampling, analysis, measurements, examinations, calibrations and maintenance carried out under the terms of this licence.

10.2 Reports of all recording, sampling, measurements, examinations, calibrations and maintenance shall be submitted to the licensing authority as specified in this licence, in a format to be agreed with the licensing authority.

10.3 The times of the plant operating shall be submitted to the licensing authority on a monthly basis.

10.4 The licensee shall record all complaints relating to emissions from the activity. Each record shall give details of the date and time of the complaint, the name of the complainant and the exact nature of the complaint. A record shall be kept of the response to each complaint. The licensee shall submit a report to the licensing authority on a

quarterly basis, within two weeks of end of each calendar quarter, providing the above details.

10.5 The licensee's plant manager or person designated with specific responsibility for this duty shall certify all reports accurate and representative.

10.6 The licensee shall keep records of all monitoring carried out and shall retain such records for a minimum period of seven years. These records shall be made available to the licensing authority on request.

10.7 The frequency and scope of reporting, as set out in this licence, may be amended with the written agreement of the licensing authority, following evaluation of test results.

Reason: To provide for the reporting of adequate information to the licensing authority.

11. Financial Provisions

11.1 The licensee shall be responsible for meeting the cost of all the monitoring associated with this licence.

11.2 The licensing authority reserves the right at any time to carry out its own monitoring in addition to the above requirements and recover costs from the licensee. The costs for this service will be invoiced directly to the company.

11.3 The licensee shall pay to the licensing authority a minimum annual contribution of €500 (five hundred euro) or such greater sum as the licensing authority determines and considers necessary, towards the cost of site inspections and assessment of results of monitoring of emissions from the activity. The first payment shall be made within one month of the date of grant of this licence, and thereafter not later than the 31st day of January of each year, the licensee pay to the licensing authority this amount, updated in accordance with changes in the Consumer Price Index. A pro rata amount shall be paid for the year from the date of commencement of the activity.

Reason: To provide for assessment of and monitoring of data arising from the activity, and provided to the licensing authority.

Date 2/4/05

Donal Casey,

Senior Executive Chemist.

Appendix 3

APPENDIX 3-1

Environmental Management System

For

P. McCaffrey & Sons Limited

Ballymagroarty Quarry,

Ballintra,

Co. Donegal

Prepared by:

Earth Science Partnership (Irl) Ltd.

James Street,

Westport,

Co. Mayo

Tel: 098 – 28999

Fax: 098 – 24727

e-mail: earthsciencepartnership@eircom.net

Date: June 2006

Consulting Engineers, Geologists & Environmental Scientists

CONTENTS PAGE

1.0 INTRODUCTION 3

1.1 History of the Company 3

2.0 POLICY STATEMENT 4

2.1 Details of management organisation & responsibilities 4

3.0 REGISTER OF ENVIRONMENTAL LEGISLATION 6

3.1 Register of Legislation 6
3.2 Environmental Guidelines 6

4.0 ENVIRONMENTAL EMERGENCY RESPONSE 7

4.1 Contact Details 7

6.0 PROCEDURES ON SITE/PROCESSES CARRIED OUT ON SITE 9

7.0 ENVIRONMENTAL ASPECTS/MONITORING 10

7.1 Noise 10
7.1.1 Noise Limits 11
7.1.2 Monitoring 11
7.2 Blasting and Vibration 12
7.3 Dust & Air Quality 15
7.4 Water 17
7.4.1 Monitoring 17
7.4.2 Water Management 18
7.4.3 Receiving Waters 18
7.4.4 Bunding tanks 19
7.5 Waste Management 20
7.5.1 Oil 20
7.5.2 Batteries 20
7.5.3 Waste Metal 20
7.5.4 General Waste 21
7.5.5 Paper Waste 21
7.5.6 Waste Tyres 21
7.6 Visual Impact 23
7.7 Transport 24
7.8 Reinstatement & After-Use 25
7.9 Ecology 26
7.10 Archaeology 26
7.11 Energy 27
7.12 Public Safety 28
7.13 Good Housekeeping 29
7.14 Community Relations 30

8.0 MONITORING 31

8.1 MONITORING CARRIED OUT ON SITE 31
8.1.1 Air *31*
8.1.2 Noise *31*
8.1.3 Blasting & Vibration *32*
8.1.4 Water Quality *32*
9.0 COMPLAINTS & ACTIONS **33**
10.0 ENVIRONMENTAL ACHIEVEMENTS TO DATE **35**

Appendices

Appendix I –Sampling Locations

Appendix II –Environmental Monitoring Report 2006.

1.0 Introduction

Earth Science Partnership Ltd (ESP), Consulting Engineers, Geologists and Environmental Scientists, were instructed by P. Mc Caffrey & Sons Ltd., ('The Client') to develop an Environmental Management System for their quarry.

The purpose of an Environmental Management System (EMS) is to show that P. McCaffrey & Sons Ltd. is committed to a policy of compliance with all applicable legislation and regulations and, beyond that, committed to continuous improvement in environmental performance.

An EMS can

- Provide confidence in the commitment from P. McCaffrey & Sons Ltd.'s management team to meet the objectives and targets set out in its policy,
- Show how Mc Caffrey & Sons Ltd. places an emphasis on prevention rather than corrective action.
- And that they are committed to continual improvement.

1.1 History of the Company

The extraction of limestone at Ballymagroarty Quarry, Ballintra, Co. Donegal was initiated in the 1940's by Donegal County Council. Patrick Mc Caffrey & Sons Ltd. took over the operations at the site from Donegal County Council in 1969. Due to the size of the quarry area and the quality of the limestone being extracted, Mc Caffrey & Sons foresee being in operation at this location for numerous years to come. Within this time they hope to reduce, even prevent where possible the impacts the operations at their quarry are having on the surrounding environs. Mc Caffrey & Sons Ltd extract approximately 200,000 cubic meters of limestone per annum.

2.0 Policy Statement

The Environmental Policy Statement outlines the objectives and commitment of P. Mc Caffrey & Sons Ltd. to prevent pollution, minimise all impacts on the environment and the local community, comply with all relevant legislation and continuously improve on their environmental performance.

This policy will be reviewed annually or when it is deemed necessary by management to ensure that the policy and the objectives set out remain relevant to P. Mc Caffrey & Sons Ltd's operations. It will be revised and reissued in accordance with changing circumstances.

The main objectives of P. Mc Caffrey & Sons Ltd's environmental policy are to recognise the potential impacts their activities may have on the environment and on the local community and to minimise these impacts where possible. P. Mc Caffrey & Sons Ltd is committed to compliance with all relevant environmental legislation and to maintain a good effective environmental management system.

2.1 Details of management organisation & responsibilities

The senior management of P. McCaffrey & Sons Ltd. are responsible for ensuring that all the objectives and commitments set out in the Policy Statement are appropriately defined, documented, implemented and relayed to all employees, contractors and visitors on the site. The Policy Statement will be reviewed annually at the Management Review and updated accordingly.

The Directors at P. McCaffrey & Sons Ltd. consists of;

- Edward Mc Caffrey
- James Mc Caffrey
- William Mc Caffrey

The Foreman on site is Mr. Adrian Britton

Environmental Policy

P. Mc Caffrey & Sons Limited operates a Limestone Quarry at Ballymagroarty Quarry, Ballintra, Co. Donegal.

We, P. Mc Caffrey & Sons Ltd. recognise that the activities, production and services that are carried out at our facility have a potential to impact on the environment and the local community. We are committed to minimising the level of impact that our operation has on the environment and where applicable provide environmental benefit.

Our objectives are to:

- Recognise all of the potential impacts the activities at our quarry has on the environment and on the local community,

- We are dedicated to minimising these where possible, and

- We are committed to complying with all existing environmental legislation and guidelines

In order to comply with these objectives an Environmental Management System has been established within the company. This system will provide a positive programme to ensure that all areas where the impacts are likely to occur are looked at in order to best protect the environment and where possible help improve the environment. This system will be incorporated as part of the every day management systems.

3.0 Register of Environmental Legislation

The Register of Legislation comprises of a list of all environmental legislation that P. Mc Caffrey & Sons Ltd. will abided by in relation to the processes and activities that are carried out on site. The register will to be updated when necessary and checked on an annual basis with any new environmental legislation, regulations or standards that are applicable to Mc Caffrey & Son's activities, processes, products and services. Consideration will also be given to proposed or pending legislation.

3.1 Register of Legislation

Licensing of emissions to waters	Local Government (Water Pollution) Acts, 1977 to 1990 Local Government (Water Pollution) Regulations, 1978 to 1999
Licensing of emissions to the atmosphere	Air Pollution Act, 1987 Air Pollution (Licensing of Industrial Plant) Regulations, 1988
Planning Permission	Planning and Development Act 2000, as amended 2002 (Section 261) Planning and Development Regulations 2001 as amended
Noise	EPA Act 1992 – 2003

3.2 Environmental Guidelines

Guidelines have been developed by numerous expert bodies to assist companies in the implementation of best practices, so that they are in compliance with all relevant legislation and that the best procedures are being followed to minimise impacts on the environment and on local communities. These guidelines include;

Draft consultation document titles "Environmental Management in the Extractive Industry (Non-Scheduled Minerals) Guidelines for Operators" – EPA October 2003

EPA (1996) Guidance Note for Noise in Relation to Scheduled Activities. EPA, Ireland

4.0 Environmental Emergency Response

Emergency plans and procedures are established throughout the company to ensure that the appropriate responses to unexpected or accidental incidents are carried out.

P. Mc Caffrey & Son's have set out a plan for emergency action to be taken in the event of an incident or potential incident at their facility, in order to protect company personnel, the general population and the environment. A list of emergency contact details are kept in prominent positions throughout the site so that they can be accessed easily in the event of an emergency. Emergency contact details include names, addresses and phone numbers for the local doctor, local authority, Gardai, fire brigade, etc.

4.1 Contact Details

Local County Council	County House Lifford, Co. Donegal	Tel Fax	074 – 9172222 074 – 9141640
	Environment Section	Tel Fax	074– 9172258 074 – 9141260
Fire Brigade	Letterkenny Central Fire Station (Office) Tel 074 – 9121676 Fax 074 - 9122284		
An Garda Síochána	Ballintra Tel 073 - 9734002		
EPA Regional Offices;	11 Rosemount Lane, Letterkenny, Co. Donegal Tel: 074 - 22274		
Northern Regional Fisheries Board;	Station Road, Ballyshannon, Co. Donegal Tel: 071 9851435		

5.0 Harmful Substances Details

The only harmful substances used at Ballymagroarty Quarry are oil, diesel and Bitumen. All these materials are stored in appropriate bunded areas on site.

Procedures for accepting / dispensing fuels

Fuelling of plant machinery is carried out using fixed bunded fuel tanks.

Plant at the site is maintained and checked on a daily basis to prevent any hydrocarbon leaks.

Maintenance of septic tanks

The sewage treatment system installed at Ballymagroraty Quarry has been designed, constructed and maintained to recommended standards, such as the NSAI S.R.6: For Septic Tank Systems.

6.0 Procedures on Site/Processes carried out on site

P. Mc Caffrey & Sons Ltd is involved in the extraction of limestone. The processes that are carried out at Ballymagroarty Quarry consist of;

- Drilling, blasting and loading of rock
- Primary and secondary crushing of rock
- Screening aggregate
- Loading lorries
- Production of bituminous products
- Production of ready-mix concrete

7.0 Environmental Aspects/Monitoring

7.1 Noise

The basic principle behind quarrying involves processes that have the potential to create noise. These processes include the blasting of the bedrock, the crushing of the rock, the movement of bedrock on chutes and hoppers, the operations of machinery, etc. all of which have the potential to create noise that may impact on the surrounding environment and local residence.

P. McCaffrey & Sons Ltd. recognises that the activities that are carried out on their site have the potential to create noise levels that may cause a nuisance. In view of this, P. McCaffrey & Sons Ltd. have regular noise monitoring carried out on their site at various locations to monitor the level of noise emitted from their site and to ensure that these noise levels are within acceptable limits. In the event of these noise levels being over the permitted levels the source of such noise is determined and mitigation measures are applied to reduce the noise or where possible to prevent it.

P. McCaffrey & Sons Ltd. has implemented numerous measures to minimise the noise levels that are emitted from the plant and that could impact on the local residences. These measures include the use of cladding where possible throughout the site and the development of earth mounds around the perimeter of the site which will act to help absorb the noise emitted from the activities carried out on site. To date P. Mc Caffrey & Sons Ltd. have received no complaints in relation to the noise that is generated from the activities carried out at the quarry. The location of the quarry site is adjacent to a National Primary Road (N15) and few residences are situated along the boundary roads to the quarry, this results in the traffic noise from the site not having a significant impact on the surrounding environs.

7.1.1 Noise Limits

The following are the limits on allowable noise to be emitted according to the EPA (1996) Guidance note for Noise in Relation to Scheduled Activities.

Day Time Maximum (08.00 – 20.00 hrs)	LAeq	55dB(A)
Night Time Maximum (20.00 – 08.00 hrs)	LAeq	45dB(A)

7.1.2 Monitoring

A noise survey monitoring the noise emissions from activities carried out at Ballymagroarty Quarry was carried out on the 30th September 2002 at 4 locations in the vicinity of the working quarry. The monitoring and reporting was carried out by Earth Science Partnership on behalf of P. Mc Caffrey & Sons Ltd. The report checked for any noise levels in excess of the set limits of 55 dB (A). Measurements were recorded using a Larson Davis Model 812, integrated sound level meter, serial number 0646, which was calibrated before and after the survey. The survey recorded noise levels above 55 dB (A) and below 55 dB (A). However the survey was only carried out for 15-minute intervals at each location and it is recommended that a longer test period of 60 minutes be used to gather a more representative idea of the noise generally emitted from the activities at the quarry.

7.2 Blasting and Vibration

Due to the nature of quarrying, blasting is a necessity so that the bedrock can be accessed. This process in itself can prove a nuisance due to the vibration and audible noise that occurs from this process. P. McCaffrey & Sons Ltd. recognises that the blasting operations that are carried out at their quarry can cause a disturbance to the local community. P. McCaffrey & Sons Ltd. wish to reduce this impact on the local residences as much as is reasonably possible. P. McCaffrey & Sons Ltd. has implemented numerous measures to try to reduce this impact where possible. These include:

- The Control of Maximum Instantaneous Charge (M.I.C.)
  This is achieved by
  - reducing face heights to facilitate a lesser charge weight
  - double deck individual holes used
- The MIC of every blast is calculated prior to drilling of each quarry face to ensure the vibration limit is not exceeded.
- Holes will be settled out after the face has been mucked out to prevent higher than expected vibration readings.
- Subgrade drilling will be controlled
- Correct sized drill bit sizes will be used to reduce the cause of excess vibration or excessive flyrock
- Air overpressure is controlled by making sure collar height of each drill hole will not exceed 4.0 metres
- Holes with light burdens are loaded according to blast design
- Face proofing is applied
- Proper chippings are used to fill holes in each blast
- Blast size is controlled by the number of holes in used in the blast

Other mitigation measures that have been applied on site to reduce the noise levels from the blasting include the building of mounds around the plant and the planting of trees around the perimeter of the quarry. These obstructions will act to adsorb the noise omitted from the quarry due to the blasting.

P. McCaffrey & Sons Ltd. has contracted Irish Industrial Explosives Ltd. to carry out vibration reading for each blast that occurs at the quarry. The vibration readings are usually carried out at the nearest sensitive location or where ever it is deemed necessary.

Irish Industrial Explosives Ltd. issues a report to P. McCaffrey & Sons Ltd after each blasting episode; these records are kept on file at the quarry. If the recorded level exceeds 12mm/sec measured in any mutually orthogonal directions or the noise level of 130 dB Linear Maximum Peak Value, then action will be taken by Irish Industrial Explosives Ltd and P. McCaffrey & Sons Ltd. to ensure that these levels will not be exceeded on a future blast. These thresholds limits for blasting have been set by the Irish Concrete Federation (ICF).

To further reduce the impact blasting has on the local residences, prior notification, before blasts are to occur will take place. This will be in the form of a telephone call on the morning of the blast. There are four households in the vicinity of the quarry who are notified of the quarries intention to blast.

Monitoring is carried out at two locations (nearest residences). Ground vibration and air overpressure readings are recorded at each of the monitoring locations. The distance from the blast and the weather conditions are also recorded.

A copy of the levels of vibration and air overpressure recorded during blasting operations at two sensitive locations can be seen in the following table.

Results of readings taken for Air Overpressure and Ground Vibration at two sensitive locations during blasting operations

		S. Kilpatrick		Shantie Namara	
Date of Blast in 2004		Ground Vibration	Air Overpressure dB(lin)	Ground Vibration	Air Overpressure dB(lin)
January	8th	5.5	118	1.6	120
	22	3.7	114	1.4	115
	28				
February	4	3.7	117	1.6	115
	24				
	25	7.0	120	1.4	122
March	24	5	108	1.2	114
April	7	6.1	117	2.2	129
	22	1.6	119	<1.5	<133
	29	8.2	115	0.8	133
June	4	4	116	1.6	114
	25			2.2	122
July	9	0.2	109	<1.5	<122
	16	3.5	114	0.8	100
August	20	2.0	120	1.3	114
	27	4.7	117	3.0	114
September	22	4.3	114	1.2	109
October	4	5.0	118	1.6	117
	4	3.0	118	1.0	119
	18	2.5	115	2.0	117
	22	6.5	118	1.8	116
November	5	2.7	125	2.3	120
	19	5.7	116		
December	3			4.8	114
	17	3.7	123	<2.5	<128
	17	6.3	127	<2.5	<128

7.3 Dust & Air Quality

As with noise, there are a numerous sources where dust can be generated within quarries. Dust can be generated from activities such as stripping of top soil, the excavation of limestone, the crushing and screening of aggregates, ancillary activities such as concrete mixing, and the transport of machinery.

Due to the possible occurrence of high levels of dust, monitoring is carried out on a regular basis at the quarry. The German TA Luft Air Quality Standards using the Bergerhoff Dust Gauge method is used to measure dust deposition in the area. This method involves the placement of dust jars in various locations throughout the perimeter of the quarry to collect a representative measure of the amount of dust particles that are present in the air due to activities carried out at the quarry. The dust jars are left *in situ* for a period of 30 days +/- 2 days before they are removed and sent for analysis. Analysis involves the matter that has been collected in the dust jars to be dried, weighted and analysed for total solids, ash and heavy metals.
The T.A. Luft method sets a dust deposition (soluble and insoluble) limit of 350 mg/m^2day.

Under the Air Pollution Act, 1987, the following ELV's are recommended for emissions to air arising from asphalt / tar macadam plants;

Sulphur Dioxide	500 mg/Nm^3
Nitrogen Oxide	450 mg/Nm^3
Carbon Monoxide	170 mg/Nm^3
Dust	50 mg/Nm^3

The main sources of dust emissions from quarry activities are from point sources and fugitive sources. At Ballymagroarty Quarry, point sources are emitted from crushers & mills, filter stacks. Fugitive emissions are created from the stock piles and pit floors.

To help minimise the amount of dust particles emitted from the activities carried out at the quarry, P. Mc Caffrey & Sons Ltd. have implemented various mitigation measures. These mitigation measures include:

- Enclosures around crushers and screens
- Dust filters
- Maintenance of good internal road surfaces,
- Water spraying on conveyors, stockpiles, and internal roads to dampen down any dust generated,
- Berms and vegetation planted to minimise soil blow-off from the site,
- Tree planting to minimise soil blow-off from the site and to reduce wind impact on the site,
- Wheel wash for road traffic is used to remove any dirt and dust particles that may be attached to the vehicles and therefore prevent the dust from being transported to other areas,
- Spraying of roads with a fine mist of water to dampen down any dust present. This will prevent the dust particles from becoming air borne and thus becoming a nuisance.

7.4 Water

Water is an essential element to quarrying whether it is as dust suppression, the washing of aggregates, washing of vehicles, or to aid in the manufacture of products at the quarry. P. McCaffrey & Sons Ltd. recognises that water plays an important role in some of the activities that take place at their quarry. Due to the nature of these activities they have the potential to impact on the quality of the water used and on the receiving water bodies where the water is discharged. P. McCaffrey & Sons Ltd. accepts that one of their main objectives is to protect the existing surface water and ground water courses and to install good water management practice through the activities at their quarry.

To reduce the impact the activities of the quarry have on the quality of the surface water and ground water in the area mitigation measures are applied. These mitigation measures include the installation of settlement and filtration systems and the recycling of water in processes where possible.

7.4.1 Monitoring

Due to the nature of quarrying and the use of water on the site, monitoring of both ground water and surface waters are carried out on a regular basis. P. Mc Caffrey & Sons have discharge/sampling chambers situated at exit points from their quarry. Monitoring is carried out every three months. The following table shows typical levels obtained from water analysis and the threshold limits place on the discharge water. More detailed results are provided in Appendix II Environmental Monitoring Report 2006.

Parameter	Typical value obtained	Threshold limit set
pH	8.2	9
Total Suspended Solids	<4	35
BOD	<1	25

7.4.2 Water Management

P. McCaffrey & Sons Ltd. has established a water management system, implemented throughout their quarry to optimise the use of all waters on site and to protect the quality of the receiving water bodies. The water management system at Ballymagroarty Quarry acts to monitor and control all water movements on the quarry from surface runoff to water used in its processes and to the quality of the water before it is discharged from the site.

The quarry can be divided into two distinctive areas with separate trade effluent discharge points. The main quarry consists of all the fixed plant. The excess water from this area of the quarry is collected on the quarry floor and is pumped to a settlement lagoon where it is given sufficient time for the suspended solids to settle out of suspension. Where possible this water is reused and recycled on site to provide water for the quarry plant, wheel wash, sprinkler system, and various other uses on site. The excess clean effluent is then discharged from the site into a stream adjacent to the N15. The second part to the quarry (known as the North Quarry) is a separate excavation with no fixed plant and is used solely for the excavation of rock and transportation of the material to the main quarry for processing. Surface water is collected in the floor of the quarry where it is pumped into settlement lagoons before being discharged from the site. The effluent is discharged into a stream adjacent to the quarry.

7.4.3 Receiving Waters

The final receiving waters for the discharge are Durnesh Lough, cSAC. Durnesh Lough is situated approximately 4.5 km from the discharge point at Mc Caffreys Quarry. Durnesh Lough is classified by the National Parks and Wildlife Services as a candidate Special Ares of Conservation because it hosts some species of flora and fauna that are protected under European legislation namely the EU Habitats Directive. Durnesh Lough is also ranked as amongst the best 10 lagoons in Ireland, which is a prority habitat in Annex I of the EU Habitats Directive. Also present are *Molinia Meadows*, another Annex I habitat.

Durnesh Lough has also been recorded as supporting populations of Otter (species listed under Annex II of the Habitats Directive), Bewick's Swan, Whooper Swan and Greenland White-fronted Geese (all listed under Annex I of the Birds Directive.

7.4.4 Bunding tanks

Bunding tanks are used for the storage of fuels, oils, chemicals, additives and bitumen. Bunded areas act as a protective enclosure to prevent any liquids spilt from these tanks from entering a watercourse or drain where they could ultimately impact on the water quality. Each tank in the bunded area is clearly and individually labeled as to its contents, its concentration and its volume. The capacity of the bunded area is to be able to hold 110% of the capacity of the largest tank within the area. Mc Caffrey & Sons Ltd. has recently installed a new mobile double skinned tank with a 3,500 litre capacity. The oil drums for the garage have also been bunded. An oil interceptor has been installed beside the garage to collect any accidental oil or fuel spills that may occur.

7.5 Waste Management

P. McCaffrey & Sons Ltd. recognises that it is their responsibility to ensure that all waste generated at their facility is properly recovered / recycled / or disposed of. To ensure this, a waste management plan has been establish on site. The waste management plan involves the allocation of proper facilities on site for the segregation of waste into separate waste streams, the temporary storage of different waste streams until they are removed from site, the use of properly permitted waste collection contractors and the prevention of fly-tipping on or near their site.

Wastes that will be dealt with on site:

7.5.1 Oil

Waste oils from the garage area are collected and stored in a bunded area on site. Ballymagroarty Quarry have commissioned Atlas Oil to collect all waste oil from the quarry and recycle it for further use.

7.5.2 Batteries

P. McCaffrey & Sons Ltd. has contracted Returnbatt Ltd. to collect and dispose if any waste batteries from the site. The company supplies a battery waste box which is collected on an 'as filled' basis.

7.5.3 Waste Metal

P. McCaffrey & Sons Ltd. has an agreement with Erne Recyclers Ltd. from Kinlough, Co. Leitrim to collect and dispose of waste metals from the quarry. An area has been designated for the storage of the metal until it is collected.

7.5.4 General Waste

P. Mc Caffrey & Sons Ltd employs a wheelie bin service on a contract basis for general waste from the site such as canteen waste. The waste is collected on a weekly basis by Laghey Waste Ltd, Donegal who dispose of the waste appropriately.

Figure 1. One of the many Wheelie bins located throughout the quarry

7.5.5 Paper Waste

A recycling company has been employed by P. McCaffrey & Sons Ltd. to collect and recycle any waste paper from the site. Laghey Waste Ltd, from Donegal collects the waste office paper to be recycled every three weeks.

7.5.6 Waste Tyres

P. McCaffrey & Sons Ltd. retains all used tyres on site and positions them on the haul roads as safety barriers. The tyres that are not used on site are disposed of by Donegal Tyre Centre Ltd.

7.5.7 Waste Concrete & Tarmac

P. McCaffrey & Sons Ltd. has a practice that all returned materials are recycled. This is achieved by the implementation of designated areas for returned road materials for recycling in cold mix plant and returned concrete put into moulds.

Illegal dumping by other parties within the site or at the quarry boundary is prevented by the erection of CCTV, boundary fencing, gates to extraction area locked at night, and regular inspections of the areas.

7.6 Visual Impact

P. McCaffrey & Sons Ltd. recognises that the presence of their quarry can have an impact on the visual amenity of the local area. To alleviate this P. McCaffrey & Sons Ltd. are committed to improving the visual appearance of their quarry. Some of the measures that P. McCaffrey & Sons Ltd. have applied include the management and development of landscape features around the perimeter of the quarry to minimise the visual impact of the operations from the public. Landscaping has involved the development of existing woodlands and hedgerows, to act as shelter belts and physical screens around the quarry.

The overall appearance of the quarry has been improved by the development of physical screens such as tree and hedge planting. P. Mc Caffrey & Sons Ltd. propose to further alleviate this impact by the additional planting and landscaping of the boundary to the site and the establishment of landscaped screening mounds around the site. Plantation of these areas will commence in March and April during the planting season. It is also proposed that the aluminum roofs of the buildings at the quarry site will be painted green to aid in their camouflage in the area.

Figure 2: Planted Berm and Screen.

7.7 Transport

P. Mc Caffrey & Sons Ltd are aware that the traffic generated from the operations at their quarry may impact on the surrounding environs. P. Mc Caffrey & Sons Ltd is committed to reducing this impact where possible and has implemented numerous mitigation measures. These mitigation measures include;

- All vehicles on site are regularly serviced and maintained to a high standard in order to reduce the noise and emissions that they emit.
- All vehicles are fitted with the necessary safety equipment i.e. beacons, flashing lights, upright exhaust systems to prevent dust being blown around, reversing alarms, roll over covers etc.
- The prevention of reversing unless necessary as this will reduce the noise generated from the site.
- Public roads will be swept when necessary
- All lorries are wheel washed before weighing and leaving the quarry, see figure 3.
- All transport vehicles are maintained in a clean and appropriate visual appearance.
- All tarmac lorries are sheeted before leaving the site
- Lorries transporting fine dry materials are trimmed/sheeted/dampened to prevent the fine material from escaping the trailers.
- Designated areas are appointed for staff and visitor parking. These areas are appropriately signposted and have sufficient lighting.

Figure 3: Wheel wash in operation at the quarry

7.8 Reinstatement & After-Use

P. McCaffrey & Sons Ltd. operates a limestone quarry at Ballymagroarty Quarry, Ballintra, Co. Donegal. This quarry is predicted to be in operation at this location for approximately another 50 years or more. The total site area of the quarry is 33.9 hectares. P. McCaffrey & Sons Ltd. have developed a restoration plan to reinstate the exhausted quarry into an amenable area after all operations have ceased. Some restoration plans will be implemented on a phased basis. This will help to re-establish the area as a natural landscape on an on-going basis, which will mean that when all activities cease at the quarry, some vegetation will have become established in the area, which will help the quarry as a whole to return to a natural environment.

P. Mc Caffrey & Sons Ltd. propose to;

- remove all plant and machinery from the site on completion of all quarrying activities;
- demolish structures on the site;
- secure all site boundaries;
- level and/or remove all spoil heaps;
- fill in any deep excavations where required;
- decommission lagoon areas;
- control the blasting at the quarry so that the sides and faces of the quarry slope are less than 50 degrees;
- grade the finished ground levels and redistribute mounds and topsoil heaps along the finished ground;
- allow the entire area to re-vegetate as a parkland/wildlife habitat for use by the local community.

7.9 Ecology

Due to the nature of quarries and the activities that are associated with them, they have a potential to impact on the ecology of an area. This impact can affect the behavioral patterns, populations and lifecycles of all living things in the area. Quarry operators need to be aware of the potential impacts the excavation and processing at the quarry can have on the flora and fauna in the vicinity of the quarry. To determine what these impacts are, their severity and significance, an ecological impact assessment needs to be carried out on all sites. An invertebrate analysis was carried out in June 2005.

P. McCaffrey & Sons Ltd. had an ecological survey of the land surrounding their quarry carried out. This survey did not find any area on or near the quarry to be an area of significant sensitivity such as a Proposed Natural Heritage area or a Candidate Special Area of Conservation. Therefore no specific protection measures need to be applied to the area. P. McCaffrey & Sons Ltd. are not interfering to a great extent on the existing habitats as there is very slow land usage at the quarry due to the deep workings that are carried out. P. McCaffrey & Sons Ltd. has begun to develop woodland in the area, which will help to create new habitats and encourage the establishment of flora and fauna in the area.

7.10 Archaeology

Our archaeological heritage is a non-renewable resource that is being impacted on by quarrying activities.

P. McCaffrey & Sons Ltd had an archaeological survey carried out at their Ballymagroarty Quarry in 2001 by Moore Archaeological & Environmental Services Ltd. This study found that there are no sites of archaeological significance located on their site at location. The Moore Archaeological & Environmental Services Ltd. recommended that 'no further mitigation be required and that the development be allowed progress'.

7.11 Energy

Quarries and their associated ancillary facilities in general are large users of energy, both as fuel and electricity. There are significant environmental and financial benefits from ensuring that the use of energy is optimised on sites. Energy use can be optimised by identifying the key areas where it is used and recognising where energy consumption can be reduced or used in a more economical manner.

This is achieved by monitoring energy consumption on site for both electricity and fuel use. From this monitoring various control procedures have been put in place by P. McCaffrey & Sons Ltd. to help conserve energy consumption on their site. These procedures include;

- Heating control measures
- Insulation of buildings
- The shut down of idling plant and conveyors
- Tariff management
- Efficient motors
- Regular maintenance of machinery and equipment to ensure that they are work efficiently
- Use of storage heater in offices and canteens
- Consider energy consumption when purchasing new equipment and machinery
- Installation of a Watt-less Unit Control System

P. McCaffrey & Sons Ltd. recognises the benefits of optimising energy use on their premises. They propose to maintain their current level of awareness and to review the procedures in place annually to ensure they are maintaining their efficiency.

7.12 Public Safety

P. McCaffrey & Sons Ltd. are committed to protecting all members of the public from any danger while they visit the quarry site.

No members of the public are allowed on site without being escorted by a member of staff and being appropriately attired. Safety equipment (hard hats and visibility vests) are available in the office for visitors to the site.

P. McCaffrey & Sons Ltd. have identified all areas of the quarry that pose a risk to members of the public and visitors to the site. Appropriate control measures have been implemented to prevent these risks from impacting on individuals.

P. McCaffrey & Sons Ltd. have ensured that their facilities area is secure and in a safe condition by;

- All relevant safe passes, machine tickets and passes are necessary in the quarry workings
- Erecting suitable hazardous signs throughout the quarry area
- The site boundary has been secured by fencing, CCTV, security guards, etc
- All steep faces have been fenced
- All ponds and lagoons on site have been properly fenced
- Life preserves have been located at ponds

Proper notification has been erected throughout the quarry site. This has been achieved by;

- The erection of warning notices on approaches to the site entrance
- Appropriate safety warning notices have been erected throughout the quarry site
- All erected signs are clear, well maintained and give clear instructions
- All working areas are well lit
- All working areas are kept tidy and free of obstructions

7.13 Good Housekeeping

The overall condition of the entrances, plant and buildings at P. McCaffrey & Sons Ltd. are kept in good condition. This helps to reduce the impact the existence of the quarry has on its surrounding environs.

P. McCaffrey & Sons Ltd. has incorporated certain measures into their management programme of plant machinery and equipment to reduce noise, dust and visual impacts from the quarry. These measures include the replacement of any damaged conveyors, or damaged plant and building panels. Soundproofing associated with the plant and all equipment will be maintained and changed wherever necessary.

The plant stockyard and quarry areas are kept tidy by the implementation of;

- Designated stock areas,
- Designated scrap storage areas,
- Internal roads are paved or leveled

P. McCaffrey & Sons Ltd. ensures that all office and employee's facilities are kept clean by the routine cleaning of toilets on a weekly basis and the routine cleaning of offices and canteens also on a weekly basis

Buildings on the quarry site will be painted suitable colours to keep in contrast with the surrounding area and help minimise their visual intrusion.

Training is provided annually to all employees on health and safety and environmental issues associated with the quarry, to ensure they are reminded of and continue to implement best practices in these areas.

7.14 Community Relations

P. McCaffrey & Sons Ltd. recognises the importance of maintaining good relations with the local community in Ballymagroarty and Ballintra. P. McCaffrey & Sons Ltd. have established links with the local community through supporting numerous local events. Some of the organizations sponsored by P. Mc Caffrey & Sons consist of;

- Ballyshannon Musical Society
- Saint Vincent de Paul, Ballyshannon
- Ballintra Races
- Open Day Golf, Donegal Golf Club
- G.A.A Golf Classic, Bundoran Golf Club
- G.A.A. Melvin Gaels, Kinlough
- Ballyshannon Agricultural Show
- Sheil Hospice Patients Comfort Fund
- Ballyshannon Drama Society
- Colaiste Cholmcille, Ballyshannon
- Irish Deaf Sports
- St. John Bosco Boxing Club, Donegal

P. McCaffrey & Sons Ltd. ensures that all their employees are aware of the environmental aspects of the activities from the quarry operations and how these impacts are reduced. This information is relayed to all staff members through appropriate regular training.

P. McCaffrey & Sons Ltd. recognises the importance of maintaining good relations with members of the local community. That is why all complaints are addressed with utmost importance and rectified wherever possible. All complaints that are received are recorded in a set format with the date, time complaint was received, who received the complaint, who made the complaint, what the complaint was in relation to and what action was taken to rectify the matter. The complaint must be signed off by a member of management.

8.0 Monitoring

Results and records of all monitoring carried out on site are kept on file in the quarry office. These results are used to evaluate the performance of the activities at quarry, ensuring they are not impacting on the surrounding environment and to observe that the emissions from the quarry are within all set limits. This data is also used to monitor the quarry's progress in improving its environmental performance.

.

8.1 Monitoring carried out on Site

Monitoring is carried out on a regular basis on various key environmental issues. The main elements monitored are Air (dust deposition), Noise, Blasting and Vibration, Surface Water Quality and Ground Water Quality. These environmental characteristics are monitored to establish how the operations from the quarry are impacting on each of these factors. Each parameter is monitored at varying rates.

8.1.1 Air

Air (dust deposition analysis) is carried out monthly. Sampling is carried out over a 30-day period +/- 2days. The sampling method used is the Bergerhoff Dust Gauge method set out in the German TA Luft Air Quality Standards. Results from previous sampling is recorded and kept on file.

8.1.2 Noise

Noise monitoring is carried out annually at sensitive locations near the quarry site, or whenever necessary. At least four locations around the perimeter of the quarry are monitored for a period of 1 hour each. The noise is monitored using a Larson Davis Model 812, integrated sound level meter, serial number 0646. Results from the noise surveys are kept on file in the offices at the quarry.

8.1.3 Blasting & Vibration

Irish Industrial Explosives Ltd. carries out the blasting and monitoring of the vibrations at Ballymagroarty Quarry. A Vibrograph Test is carried out during all blasting. Blasting only occurs during the hours of 10.00 and 15.00 on allocated days. Blasting takes place approximately once every two weeks at Ballymagroarty Quarry.

8.1.4 Water Quality

Samples of surface waters, ground waters and water effluent discharges from around the quarry have been taken on a monthly basis.

9.0 **Complaints & Actions**

Due to the nature of quarries and the activities that occur on site, some members of the public may become agitated and issue complaints towards the quarry. P. McCaffrey & Sons Ltd. regards these complaints with the utmost importance. P. McCaffrey & Sons Ltd. have set procedures in place to be followed whenever a complaint is made to the quarry. These procedures involve filling out a complaints form outlining the date the complaint was made, who made the complaint, what the complaint was about and what action was taken to rectify the complaint. All complaints must be signed off by a member of management to ensure that they were dealt with in the proper manner.

Complaint Record

1.0 Date of Complaint: _____ **2.0 Time:** _____

3.0 Complaint Method: _____ **4.0 Taken by:** _____

5.0 Name & Address of Complainant: _____

_____

6.0 Nature of Complaint: _____

_____

_____

7.0 Detail Investigation Action Taken & Identify the Investigating Person

_____

_____

_____

8.0 Detail Weather Conditions: _____

9.0 Detail Results of Investigation

_____

_____

10.0 Detail any corrective & preventative action taken

_____

_____

11.0 Detail whether complainant was contacted

_____

_____

Signed: _____ Date: _____

10.0 Environmental Achievements to Date

1. P. Mc Caffrey & Sons Ltd has obtained an Air Discharge Licence.

2. A wheel wash system for all vehicles leaving the quarry site has been installed in order to keep the county and national roads clean.

4. Consultants namely Earth Science Partnership Ltd. (ESP) has been appointed to monitor P. Mc Caffrey & Sons Ltd environmental compliance.

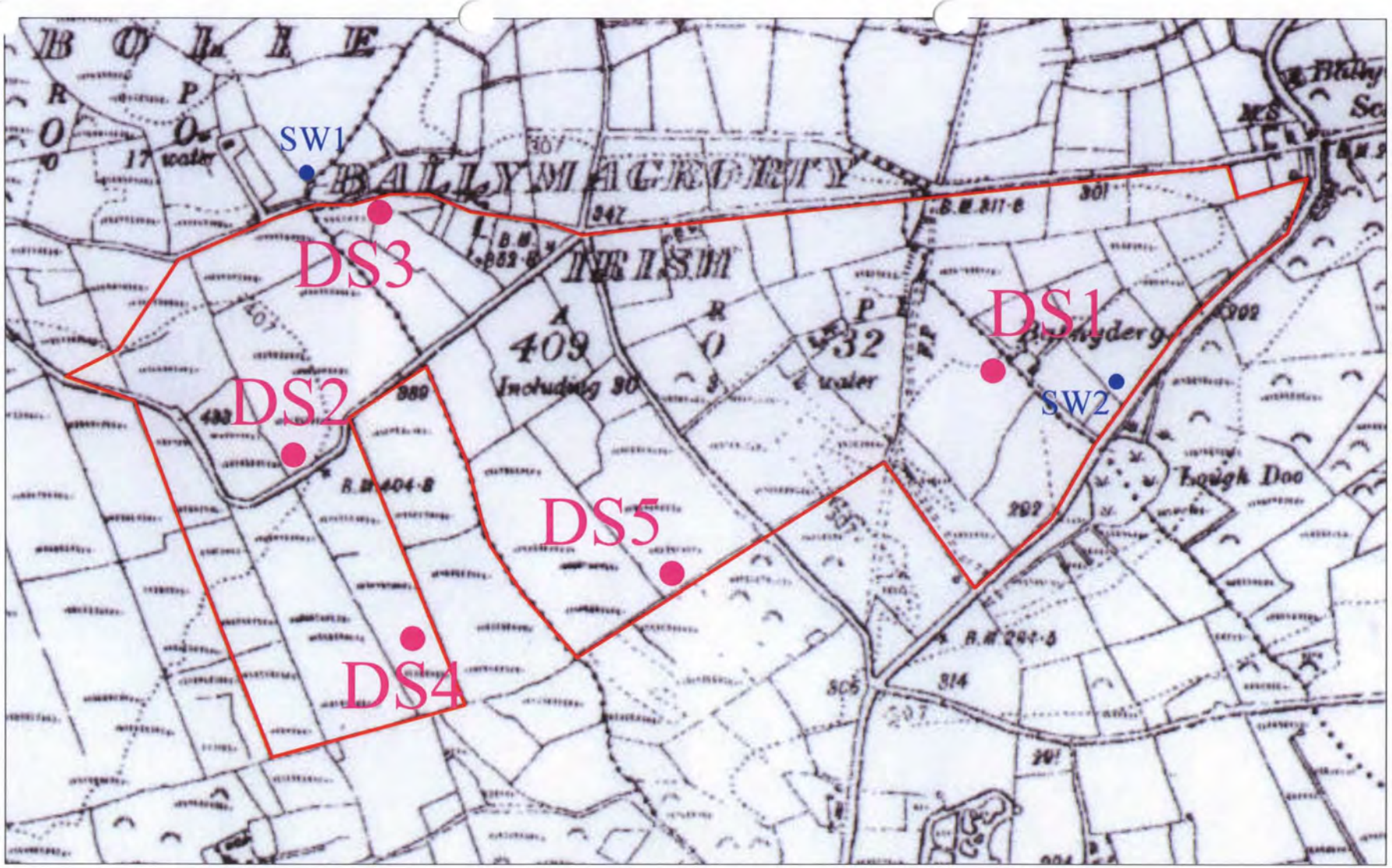
5. We have appointed licensed waste collectors to deal with all waste produced on site.

6. The installation of a new mobile double skinned fuel tank with a 3,500 litre capacity.

7. The installation of an oil interceptor beside the garage and fuel tanks.

Appendix I

Sampling Locations



North

EARTH SCIENCE PARTNERSHIP

CONSULTING ENGINEERS, GEOLOGISTS & ENVIORMENTAL SCIENTISTS

James Street Westport Co. Mayo
tel:- +353(098) 28999 fax:- +353(098) 24727
email: earthsciencepartnership@eircom.net

Copyright Licence No. EN0021405

Project:-	EMS
Title:-	Dust Station & Surface Water Monitoring Locations
Drawn By: E Naughton	
Scale: 1/5,000	Date: February 2006

Appendix II

Results of Analysis on Bergerhoff Gauges & Surface water

EARTH SCIENCE PARTNERSHIP

CONSULTING ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

James Street, Westport, Co Mayo.
Tel (098) 28999 Mob: 087 2050504 Fax: (098) 24727
E – mail: earthsciencepartnership@eircom.net

E.S.P

Customer Name McCaffreys **Ref No** EI027 **Monitor Collection Date** 25/5/06

RESULTS FOR MAY 2006

SURFACE WATER

RESULTS			
	Test	**Result**	**Limits**
SW1	Temperature	9.9	25^0
	pH	7.6	6-9
	Conductivity	520	2500uS/cm
	Dissolved Oxygen (DO)	8.6	-
	Fats, oils and Greases	1	-
	Suspended Solids (ss)	<4	≤25mg/L
	COD	<10	40mg/L 0_2
	BOD (d)	<2	5mg/L 0_2
	Ammonia as NH-3 – N (d)	0.015	0.02mg/L NH_3
SW2	Temperature	10.2	25^0
	pH	7.5	6-9
	Conductivity	484	2500uS/cm
	Dissolved Oxygen (DO)	9.59	-
	Fats, Oils and Greases	1	-
	Suspended Solids (ss)	<4	≤25
	COD	<10	40mg/L 0_2
	BOD (d)	<2	5mg/L 0_2
	Ammonia as NH3	0.094	0.02mg/L NH_3

DUST MONITORING

DUST STATION	POT REF NO	RESULTS	LIMIT
DS1	EI027DS10506	83 mg/m^2/day	180mg/m^2/day
DS2	EI027DS20506	176 mg/m^2/day	180mg/m^2/day
DS3	EI027DS30506	20mg/m^2/day	180mg/m^2/day
DS4	EI027DS40506	73 mg/m^2/day	180mg/m^2/day
DS5	EI027DS50506	74 mg/m^2/day	180mg/m^2/day

Signed: Eileen Mullarkey

EARTH SCIENCE PARTNERSHIP

CONSULTING ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

James Street, Westport, Co Mayo.
Tel (098) 28999 Mob: 087 2050504 Fax: (098) 24727 **E.S.P**
E – mail: earthsciencepartnership@eircom.net

Customer Name McCaffreys **Ref No** EI027 **Monitor Collection Date** 26/6/06

RESULTS FOR JUNE 2006

SURFACE WATER

RESULTS			
	Test	**Result**	**Limits**
SW1	No water was being pumped to the discharge point		
SW2	Temperature	11.3	25^0
	pH	7.2	6-9
	Conductivity	521	2500uS/cm
	Dissolved Oxygen (DO)	9.25	-

DUST MONITORING

DUST STATION	POT REF NO	RESULTS	LIMIT
DS1	EI027DS10506	53 $mg/m^2/day$	180$mg/m^2/day$
DS2	EI027DS20506	47 $mg/m^2/day$	180$mg/m^2/day$
DS3	EI027DS30506	46 $mg/m^2/day$	180$mg/m^2/day$
DS4	EI027DS40506	19 $mg/m^2/day$	180$mg/m^2/day$
DS5	EI027DS50506	28 $mg/m^2/day$	180$mg/m^2/day$

Signed: Eileen McCaffrey

APPENDIX 6

Appendix 6-1

ORDNANCE SURVEY OF IRELAND.

CHARACTERISTIC SHEET

FOR MAPS ON A SCALE OF

1:10,560 or 6 Inches to 1 Mile and 1:2,500 or 25·344 Inches to 1 Mile.

BOUNDARIES

SCALES

	1:10,560 or 6" to 1 Mile.	1:2,500 or 25·344" to 1 Mile.
Counties		
Baronies		
Parishes (only shown in County Boros. & Urban Dists.)		
Townlands		
Counties & Baronies		
Baronies & Parishes		
Parishes & Townlands		
Counties, Baronies, Parishes & Townlands		
County Boroughs, Urban Districts, & Towns (when not coincident with other Boundaries)	(Described)	(Described)
Wards (only shown in County Boros.)		
When Centre of River		C.R.
When Centre of Stream		C.S.
When Side of River		S.R. S.R.
When Side of Stream		S.S. S.S.
When Centre of Road		C.R.
When Centre of Wall or Fence		C.W. C.F.
When Face of Wall or Fence		F.W. F.F.
When 6' Root of Hedge		6' R.H.

WRITINGS

Plans published prior to 1938.

*BARONIES
PARISHES
TOWNLANDS
Co BOROUGHS
MARKET TOWNS
Villages Villages (Important)
Workhouses
Bridges, Public Buildings, Churches.
RAILWAYS,
Locks, Manufactories, Bridges, &c.
PARKS
BAYS & HARBOURS
NAVIGABLE or TIDAL RIVERS
Smaller Rivers, Brooks.
Antiquities
Area Figures
4·370
Bench Marks ↑ B.M. 5·47
Minor Altitudes · 121
Initial Letters to Small Objects.
M.P Mile Post M.S Mile Stone
S.P Signal Post S.B. Signal Box*

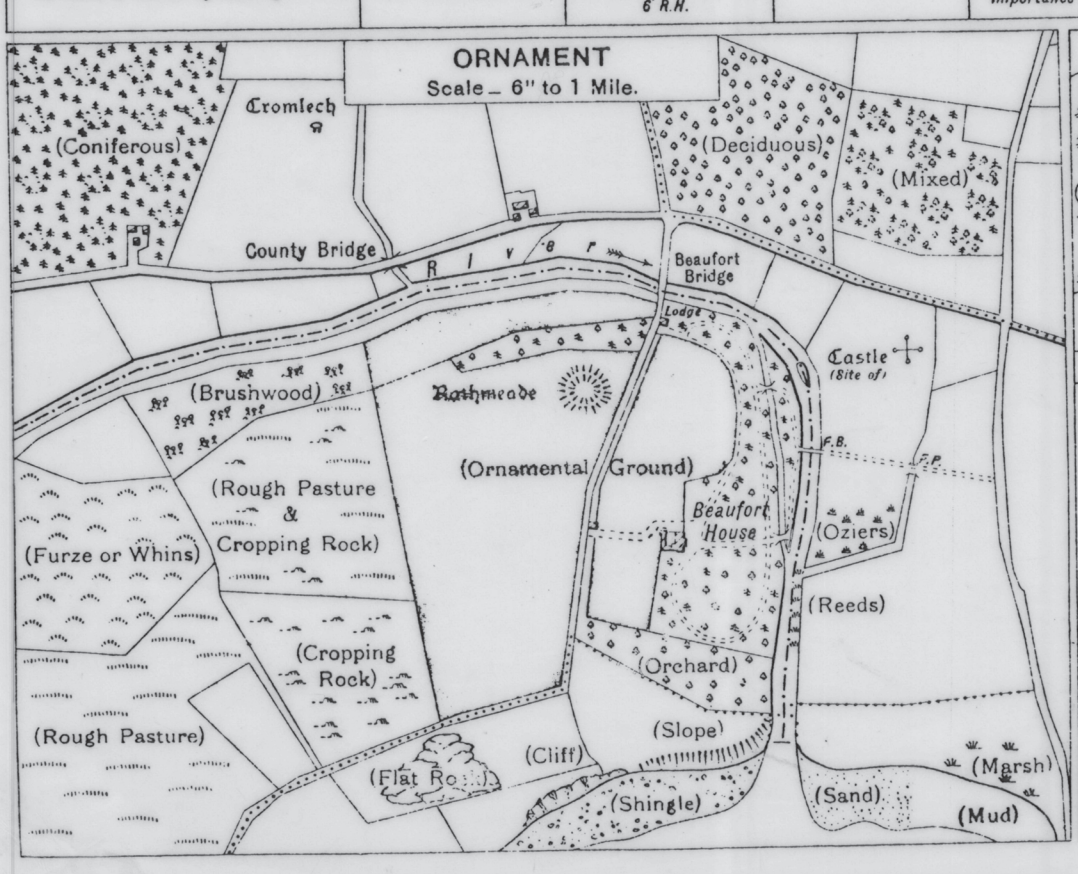
Plans published subsequent to 1938.

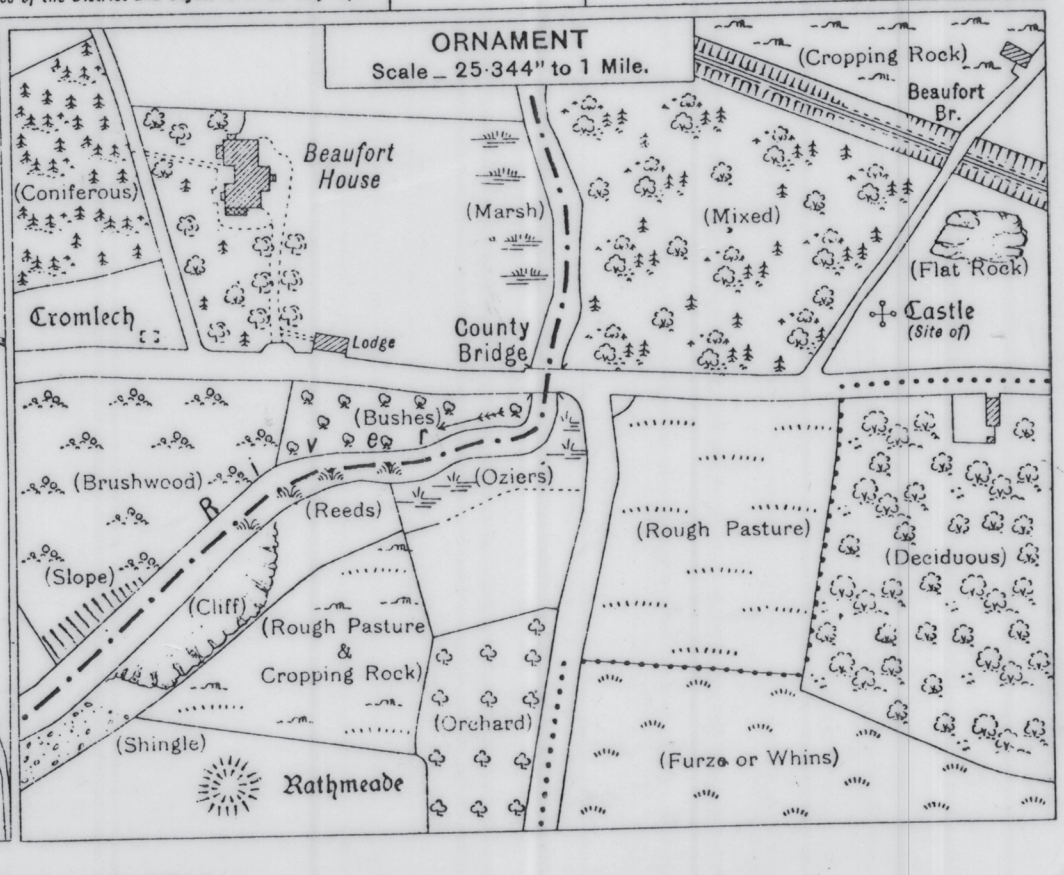
*BARONIES
PARISHES
TOWNLANDS
Co BOROUGHS
MARKET TOWNS
Villages Villages (Important)
County Homes
Bridges, Public Buildings, Churches.
RAILWAYS,
Manufactories, Locks.
PARKS
BAYS & HARBOURS
NAVIGABLE or TIDAL RIVERS
Smaller Rivers, Brooks.
Antiquities
Area of parcels given in Statute Acres, thus 4·370
Brace indicating that the enclosures so connected are included in the same area
Bench Marks ↑ B.M. 5·47
Minor Altitudes + 121
Initial Letters to Small Objects.
M.P Mile Post M.S Mile Stone
S.P Signal Post S.B. Signal Box*

These Examples vary in Size and Extent according to the Importance of the District and Object to which they refer.

SYMBOLS

Bridges
Weirs or Dams
Ferries
Fords
Canals (Cutting, Embankment)
Railways
Tunnels
Light Railways
1st Class Roads
2nd Class Roads
3rd Class Roads
Unfenced Roads
Quarries
Gravel Pits
Forts & Mounds
Wells & Springs
Pumps
Trigonometrical Station △
Contours 200 (Black)
" 200 (Red)





* Character used when entirely on body of Sheet.

APPENDIX 6-2

June 2025

Japanese Knotweed Management Plan

Ballymagroarty Quarries, Ballintra, Co. Donegal, Ireland

On behalf of

Patrick McCaffrey & Sons Ltd.

MALONE O'REGAN ENVIRONMENTAL

MALONE O'REGAN

QUALITY
I.S. EN ISO 9001:2015
NSAI Certified

Form ES - 04

MALONE O'REGAN ENVIRONMENTAL

Ground Floor – Unit 3
Bracken Business Park
Bracken Road, Sandyford
Dublin 18, D18 V32Y
Tel: +353- 1- 567 76 55
Email: enviro@mores.ie

Title: Japanese Knotweed Management Plan, Ballymagroarty Quarries, Ballintra, Co. Donegal, Ireland, Patrick McCaffrey & Sons Ltd.

Job Number: E2321

Prepared By: Emma Dolan **Signed:** _____

Checked By: Sarah de Courcy **Signed:** _____

Approved By: Dyfrig Hubble **Signed:** _____

Revision Record

Issue No.	Date	Description	Remark	Prepared	Checked	Approved
01	12/05/2025	JK Mgt. Plan	Final	ED	SDC	DH
02	06/06/2025	JK Mgt. Plan	Final	ED	SDC	DH

Copyright and Third-Party Disclaimer

Malone O'Regan Environmental ('MOR Environmental') has prepared this report for the sole use of our client (as named on the front of the report) in accordance with the Client's instructions using all reasonable skill and competence and generally accepted consultancy principles. The report was prepared in accordance with the budget and terms of reference agreed with the Client and does not in any way constitute advice to any third party who is able to access it by any means. MOR Environmental excludes to the fullest extent lawfully permitted all liability whatsoever for any costs, liabilities or losses arising as a result of or reliance upon the contents of this report by any person or legal entity (other than the Client in accordance with the terms of reference). MOR Environmental has not verified any documents or information supplied by third parties and referred to herein in compiling this document and no warranty is provided as part of this document. No part of this report may be copied or reproduced without express written confirmation from MOR Environmental. Any methodology contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of MOR Environmental. Disclosure of such information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Third parties who obtain access to this report by any means, including disclosure by the Client, will be subject to the Copyright and Third-Party Disclaimer contained herein.

Japanese Knotweed Management Plan

Ballymagroarty Quarries, Ballintra, Co. Donegal, Ireland

Patrick McCaffrey & Sons Ltd.

Contents

1 INTRODUCTION 3
1.1 Background 3
1.2 Statement of Authority 3
1.3 Purpose / Aims of the JK Management Plan 3
1.4 Site Context and Description 4
2 BACKGROUND INFORMATION 5
2.1 Legislation Relevant to Invasive Species 5
3 SITE ASSESSMENT 7
3.1 Field Study Results 7
3.2 Assessment Constraints 9
4 JAPANESE KNOTWEED MANAGEMENT PLAN 10
4.1 Description of the JK Management Plan 10
4.2 Setting Priorities 10
4.3 Specific Remediation Actions 10
4.3.1 Site Preparation 10
4.3.2 Herbicide Treatment 10
4.4 Site Biosecurity Measures 11
4.4.1 Monitoring 11
5 FURTHER REMEDIATION OPTIONS 12
6 CONCLUSION 13
7 REFERENCES 14

FIGURES

Figure 1-1: Site Location 3
Figure 3-1: JK Location 7

TABLES

Table 5-1 Further Remediation Options 12

PLATES

Plate 3-1: Disturbed Berm with Excess Materials (4th April 2025) 8

Plate 3-2: Wide View of Area which previously contained the Mature JK Stand. Additional Material on Berm Visible (4th April 2025) 8

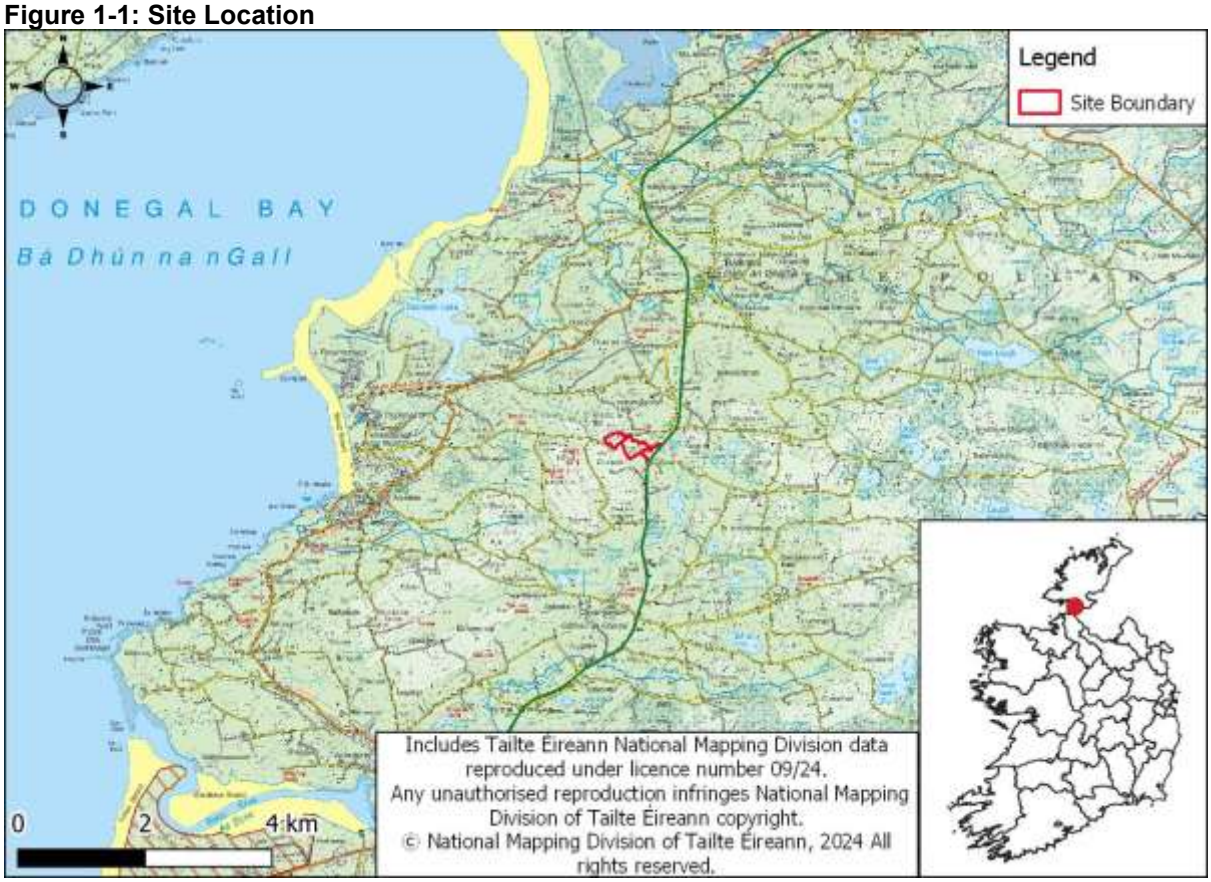
Plate 3-3: New JK Shoots Identified on 4th April 2025 9

1 INTRODUCTION

1.1 Background

Malone O'Regan Environmental ('MOR Environmental') was commissioned by Patrick McCaffrey & Sons Ltd ('the Applicant') to prepare a Japanese Knotweed Management Plan for the identified stand of Japanese knotweed (*Reynoutria japonica*) ('JK'), at Ballymagroarty Quarries, Ballintra, County ('Co.') Donegal (ITM OS Reference 590736 867405) ('the Site'). The location of the Site is shown in Figure 1-1.

Figure 1-1: Site Location



1.2 Statement of Authority

This report was reviewed and approved by Mr. Dyfrig Hubble, Associate Director - Ecologist. Dyfrig is a full member of the Chartered Institute of Ecology and Environmental Management ('CIEEM'). Dyfrig has over 18 years' experience working in the ecological consultancy sector and has extensive experience in undertaking invasive species surveys, preparing invasive species management plans and supervising the implementation of these plans.

1.3 Purpose / Aims of the JK Management Plan

The principal aim of this JK Management Plan is to remediate the JK located within the Site in order to safeguard existing operations at the Site. This JK Management Plan also aims to prevent the unintentional spread of JK during existing operations.

The key objectives of this JK Management Plan are to:

- Identify and map all locations where JK is present on the Site;
- Identify the best method for managing and controlling JK on the Site with regard to the existing operations;
- Provide an outline of the measures that will be implemented to remediate the JK on the Site;

- Provide an outline of measures which should be implemented as a matter of priority to prevent any potential spread of JK on the Site;
- Communicate the plan to all site operatives to ensure the success of the plan; and,
- Document and record the treatment and management methods carried out onsite.

1.4 Site Context and Description

The Site is situated circa ('ca.') 2.6km southwest of Ballintra village and ca. 6.4km north of Ballyshannon in County Donegal. The area surrounding the Site is characterised by a high density of one-off residential dwellings and agricultural land, primarily in the form of pastures. The N15 national road runs in a north-to-south direction ca. 150m to the east of the Site. The Site is connected to the N15 via a private road.

The Site comprises two quarry areas, the northern quarry and the southern quarry.

The southern quarry covers an area of ca. 8.64 hectares ('ha'). Quarrying operations began in the southern quarry in the 1940s and ceased by 1990. The southern quarry had been excavated to a level of ca. 54.6 metres Ordnance Datum ('mOD') by this time. Following the cessation of quarrying activities in the southern quarry, operations moved to the northern quarry. The southern quarry was then used for ancillary operations such as concrete batching, asphalt production, screening and processing of aggregates.

The northern quarry lies to the north of the L7265 local road and covers an area of ca. 4.62ha. The northern quarry was worked to a depth of approximately -13 mOD, which is below the groundwater table. The aggregate within the northern quarry was transferred to the southern quarry for processing. Operations ceased in the northern quarry in 2013 and the quarry pit was allowed to flood.

A habitat survey conducted on 23rd October 2024 recorded active processing areas, the northern quarry waterbody, settlement ponds, disturbed and recolonising bare ground and pockets of scrub within the Site boundary. Sections of hedgerows / treelines were identified bordering active areas.

2 BACKGROUND INFORMATION

JK is an injurious, invasive herbaceous perennial. Since it was introduced as an ornamental plant in the 19th Century from Japan, it has spread across much of Ireland, particularly along watercourses, transport routes and waste grounds where its movement is unrestricted.

JK is considered to be a serious issue on the basis that it can:

- Damage buildings, hard surfaces and infrastructure by growing through concrete, tarmac and other hard surfaces;
- Outcompete and negativity impact on native plants and thus animals by forming dense thickets;
- Cause damage to flood defence infrastructure along watercourses and increases flood risk through reduced capacity of channels to carry flood water;
- Negativity impact the ability of projects to gain planning permission. Proper planning process requires measures to remove and eradicate the species from a development site;
- Cost of remediation can be both expensive and negatively impact on construction works; and,
- Decrease land value.

In Ireland, JK has not yet been recorded as producing viable seeds and so far, all JK plants recorded in Ireland are female, which only reproduce through vegetative propagation. There are records of hybrid JK plant, which are male, however, as of yet no records of viable seed have been reported.

JK spreads through vegetative propagation from the crown, stem and rhizome (underground root), even small amounts of cut stem, crown or rhizome are capable of producing a new plant.

The rhizomes of JK are considered to be main cause of the spread of JK. The rhizomes are particularly resistant to dehydration and freezing and as little as 0.7 gm of rhizome can regenerate into a new plant. Therefore, when a rhizome is disturbed or cut it will produce a new shoot and it is known that digging or other disturbance, such as earth works, can significantly increase stem density. Also, JK plants can regrow from soil contaminated with JK rhizomes.

Similarly, the crown and stems of JK are also capable of regenerating. Small fragments of cut crown or stem are capable of regenerating and becoming a new plant. However, once stems are thoroughly dried, they are unable to regenerate.

Therefore, controlling the spread of JK is dependent on preventing the spread of all of these parts of the plant.

2.1 Legislation Relevant to Invasive Species

JK is a legally controlled species within Ireland due to the harm that it can cause to the natural environment and to built structures. It is controlled under the following legislation:

- Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species. [1];
- Wildlife Act, 1976 to 2012 [2];
- European Communities (Birds and Natural Habitats) Regulations 2011–2015 [3]*;*
- Planning and Development Acts, 2000 to 2016, and 2017 Amendment [4]; and,
- The European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374/2024) [5].

Under this legislation, it is an offence to:

- Plant, disperse, allow dispersal or cause the spread of JK;
- Keep the plant in possession for purpose of sale, breeding, reproduction, propagation, distribution, introduction or release;
- Keep anything from which the plant can be reproduced or propagated from without a granted licence; or,
- Keep any vector material, in this case soil or spoil taken from JK, for the purposes of breeding, distribution, introduction or release.

3 SITE ASSESSMENT

An assessment of the Site was undertaken on 23rd October 2024 by three suitably qualified MOR Environmental Ecologists. A follow-up assessment was completed on 4th April 2025 by one suitably qualified MOR Environmental Ecologist. The results are outlined below.

3.1 Field Study Results

During the survey conducted in October 2024, an isolated, mature stand of JK was identified onsite. The JK stand was identified growing out of a berm along the Site boundary. This JK stand was located within the northeast portion of the southern quarry, southwest of the L7265 junction with local roads, refer to TN1 in Figure 3-1 for indicative location.

During the updated field survey in April 2025, the mature JK stand was no longer present. The surveyor noted that vegetation in this area had been cleared, and aggregates had been placed on the berm, which previously supported the mature JK stand. Refer to Plates 3-1 and 3-2 below for context.

Three new JK shoots were identified emerging from the disturbed berm in the same place as the mature stand was recorded previously (refer to Plate 3-3 and TN1 in Figure 3-1 below for context).

No additional stands of JK were identified elsewhere on the Site during the 2025 walkover. JK was not observed along adjoining sections of the berm or within the nearby roadside verge. It should, however, be noted that given the northern location of the Site and the time of the survey (early April), not all JK shoots may have emerged yet.

It is understood that no formal treatment of the mature JK stand was carried out prior to the ground disturbance in this area. The presence of emerging JK growth confirms that the species remains active at this location.

Figure 3-1: JK Location

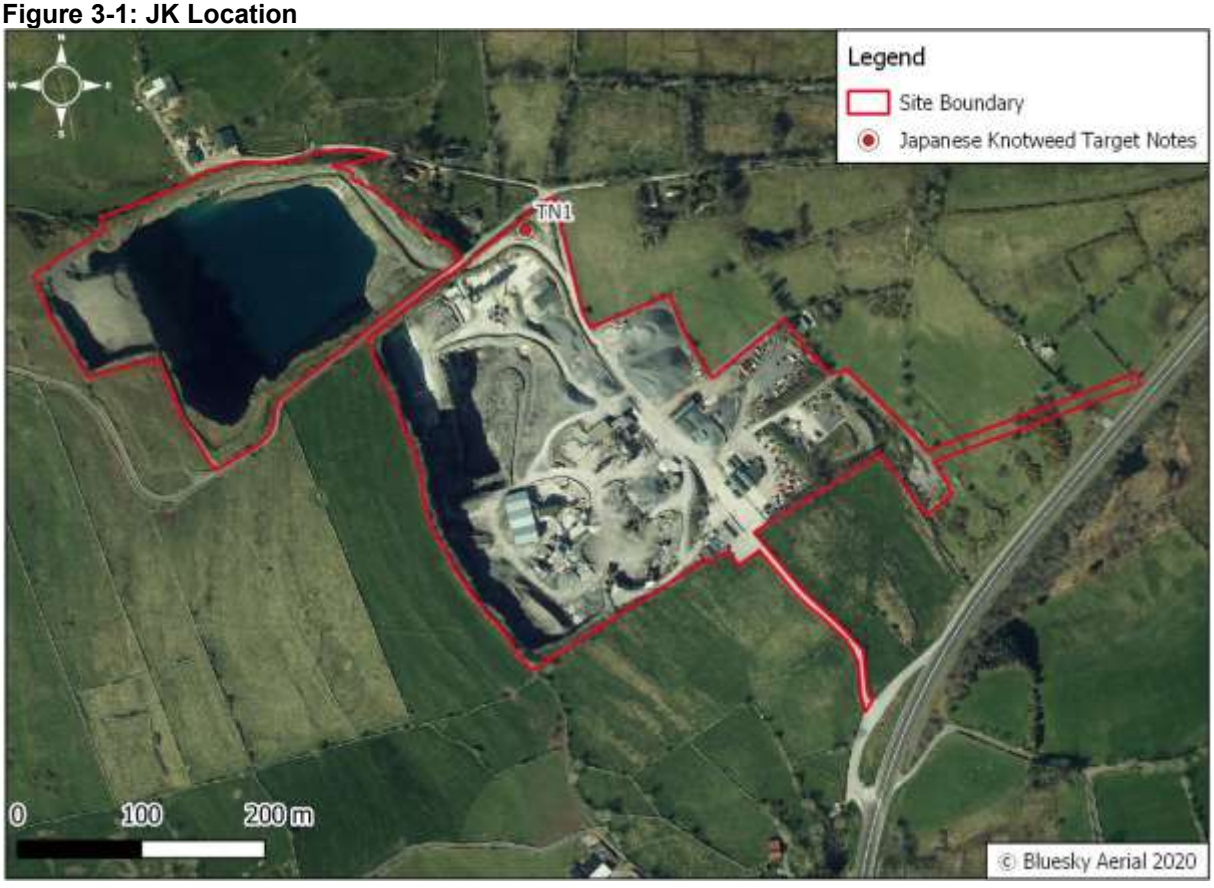


Plate 3-1: Disturbed Berm with Excess Materials (4th April 2025)

Plate 3-2: Wide View of Area which previously contained the Mature JK Stand. Additional Material on Berm Visible (4th April 2025)

Plate 3-3: New JK Shoots Identified on 4th April 2025

3.2 Assessment Constraints

During the 2024 and 2025 surveys, certain areas were inaccessible due to their proximity to active vehicle routes, operational plant and equipment or as a result of steep inclines/cliff edges. These inaccessible sections were visually assessed from their peripheries using binoculars. These areas did not show signs of supporting invasive species. Given the good visibility of these areas from afar, it is not considered that the lack of access into these areas will materially alter the findings of this assessment.

It should be noted that the optimal period for surveying JK is during its growing season (late April to the beginning of October. Therefore, the 2025 survey was conducted during the optimal survey period for this species. However, JK can be surveyed all year round. Therefore, no survey limitations in relation to seasonal constraints were encountered, and the findings of the 2024 survey remain valid.

4 JAPANESE KNOTWEED MANAGEMENT PLAN

The JK Management Plan detailed below aims to ensure the remediation of the JK onsite and to ensure that there will not be unintentional spreading of JK onsite or to locations offsite. It is recommended that JK is remediated utilising herbicide treatment. Variations to herbicide treatment should only be undertaken with advice from an experienced and competent JK specialist, and a revised plan developed.

4.1 Description of the JK Management Plan

The herbicide treatment of JK onsite shall be overseen by the project Ecologist Clerk of Works ('ECoW'). This JK Management Plan, appendices and any subsequent revisions shall be kept for future monitoring and remediation works. This JK Management Plan should be read in conjunction with:

- The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites [6];
- '*The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*' [7];
- Best Practice Management Guidelines: Japanese Knotweed *(Reynoutria japonica),* [8]*;and,*
- Best Practice for Control of Japanese Knotweed *(Reynoutria japonica)* [9].

4.2 Setting Priorities

High Priority:

- JK signage should be erected;
- Remediation of JK and prevent unintentional spread of JK; and,
- No works should take place in the area containing JK nor any areas where JK is identified in the future until the project ECoW has signed off that the JK remediation works have been completed.

4.3 Specific Remediation Actions

4.3.1 Site Preparation

Prior to any remediation works being undertaken, the following Site preparation actions will be required to limit the potential for any further spread of JK both on and off the Site:

- The infected area should be cordoned off (with an adequate 7m buffer zone) and signage should be erected to prevent access. These works should be supervised by the project ECoW;
- No vegetation management works or earthworks should take place within the area identified as having JK present or within the buffer zones;
- No new material or soil should be stored adjacent to the JK area; and,
- No plant or machinery should be tracked through the area containing JK or within the 7m buffer zone.

4.3.2 Herbicide Treatment

It is recommended that herbicide treatment be undertaken at the Site. The area containing JK (and any other areas where JK is identified) should be treated before the end of the growing season, which is typically from the end of September to the start of October. Herbicide treatments are known to be highly effective and cause significant dieback of JK. Herbicide

treatments generally take between 3-5 years with spot treatment required each year until no regrowth is observed.

The initial JK treatment should be undertaken as soon as practically possible and before the end of the growing season, this will allow the JK to draw as much herbicide as possible into the below ground rhizomes. Following completion of the initial spray, this will then need to be followed up by a programme of regular spray treatments, comprising of 3 treatments per year during the growing season for a period of 3 to 5 years.

4.4 Site Biosecurity Measures

In order to mitigate against the unintentional spread of invasive species from and to the Site, the following biosecurity measures should be implemented.

- All vehicles, machinery and any other equipment entering/leaving the Sites should be washed and cleaned before entering and exiting the Site to prevent the spread of invasive plant material;
- Before machinery or equipment is unloaded at the Site, equipment will be visually inspected to ensure that all adherent material and debris have been removed; and,
- Any vehicles and machinery that are not clean will not be permitted entry to the Site.

4.4.1 Monitoring

The treatment works should be supervised by the project ECoW. As part of these works, the project ECoW will also monitor the effectiveness of the treatment.

On-going monitoring should be undertaken by the project ECoW in conjunction with chemical treatment to provide effective control of this species, as knotweed rhizomes that have not been completely killed off may send up new shoots as many as three years later.

Continued monitoring with the Site is required in order to limit any potential spread of species to ensure desired results are being achieved and also to adapt remediation plans to improve success and treat any re-growth.

5 FURTHER REMEDIATION OPTIONS

To expedite the remediation of JK within the landholding (see Table 5-1), there are a number of remediation options that can be implemented in order to reduce the length of time required for remediation works. Combinations of the remediation options may be implemented to facilitate any potential development. Table 5-1 below provides an outline of potential options that are available.

Table 5-1 Further Remediation Options

Narrative	Advantages	Disadvantages
A) Onsite Treatment This option involves excavating the JK and stockpiling the contaminated soil within a contained bund to allow for intensive herbicide treatment.	• Far cheaper option than offsite disposal.	• A suitable sized area needs to be sterilised for the duration of the treatment process. • Bunded area would need to be fully contained. • Need for ongoing herbicide treatment. • Monitoring will be required.
B) Onsite Burial Contaminated soil and JK would be buried onsite and fully encapsulated in a lined cell. Clean soil would then be placed on top of the cell.	• Far cheaper option than offsite disposal. • No need for any ongoing herbicide treatment.	• JK would need to be placed within a full encapsulated cell. • Dependant on suitable ground conditions. • The optimum requirement would be for 2m of cover materials. • May be a need to provide backfill materials. • Low level risk would remain if the liner integrity was ever compromised. • Monitoring will be required.
C) Removal to Landfill Excavation and removal of contaminated soil offsite to a suitably licenced facility.	• Complete Removal of Soil from Site • Very quick to implement.	• Expensive option. • Availability of suitably licenced facilities would need to be considered.

6 CONCLUSION

Following the invasive species assessment carried out at the Site, one isolated JK stand was identified within the Site.

To remediate the JK onsite, the Site preparation measures, herbicide treatment and biosecurity measures detailed in Section 4 must be implemented as soon as possible. The implementation of this JK Management Plan will halt the spread of JK within the Site and ensure that JK does not spread to offsite locations. Ongoing monitoring will be carried out by the project ECoW to track treatment effectiveness and manage any potential regrowth.

7 REFERENCES

[1] EU, “Regulation (EU) No 1143/2014 of the European Parliament,” 2014.

[2] Goverment of Ireland, “Wildlife Act 1976,” 1976.

[3] G. o. Ireland, “S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011,” Ireland, 2011.

[4] G. o. Ireland, “Planning and Development (Amendment) Act 2017,” Ireland, 2017.

[5] EC, “S.I. No. 374/2024 - European Union (Invasive Alien Species) Regulations 2024,” European Union, 26 07 2024. [Online]. Available: https://www.irishstatutebook.ie/eli/2024/si/374/made/en/print.

[6] Environment Agency, “The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites,” 2016.

[7] NRA, “Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads,” National Roads Authority, 2010.

[8] Invasive Species Ireland, “Best Practice Management Guidelines: Japanese Knotweed (Reynoutria japonica),” 2008.

[9] IFI, “Best Practice for Control of Japanese Knotweed (Reynoutria japonica),” Inland Fisheries Ireland, 2012.

APPENDIX 7

APPENDIX 7-1

Notes

Elevations in metres to Ordnance Datum
Irish Grid Malin Head
Contours 1m Interval

Net Extraction Volume from Active Southern Quarry
Base on surrounding terrain levels

= 781,572 m3

Land Ownership

Application Area

No.	Revision	Drg by	Chk by

Drg by OM	Chk by LW	App by LW

Malone O'Regan Environmental

Patrick McCaffrey & Sons Ltd, Ballymagroaty Quarries, Ballintra, Co. Donegal.

South Quarry

SixWest

info@sixwest.com www.sixwest.com T 028 8673 1917

Scale 1:500 (A0)	Date July 9th, 2025

Drawing No. MM250709-10

Revision

APPENDIX 7-2

Discharge Point

QUARRY FLOOR ASSUMED 130M BELOW CREST LEVEL -13m OD

QUARRY FLOOR ACCESS RAMP

BOUNDARY

BOUNDARY

BLOCK YARD

QUARRY FLOOR ACCESS RAMP

QUARRY VOID

Building D

Building C

Building A

Building B

Building H

Building I

Notes

Elevations in metres to Ordnance Datum
Irish Grid Malin Head
Contours 1m Interval

Net Extraction Volume from Disused Northern Quarry
Base on surrounding terrian levels &
assumed floor level (-13m OD) 130m below crest.

= 3,005,325 m3

Land Ownership

Application Boundary

No.	Revision	Drg by	Chk by

Drg by OM | Chk by LW | App by LW

MALONE O'REGAN ENVIRONMENTAL

Patrick McCaffrey & Sons Ltd
Ballymagroaty Quarries,
Ballintra, Co. Donegal.

North Quarry

SixWest

info@sixwest.com www.sixwest.com T 028 9073 1917

Scale 1:500 (A0) | Date July 9th, 2025

Drawing No. MM250709-04

Revision

APPENDIX 8

APPENDIX 8-1

1. Site Location & Boundaries

The site location is described and its boundaries defined in Section 2 of this rEIS. The geographical setting and discharge mechanisms have previously been described by ONeill Groundwater Engineering (2008) and that work's detail remains valid for the site location and geographical setting. Therefore, I do not intend to repeat it in this section. I provide O'Neils Groundwater Report (2008) as an annex to this work.

In summary, the application site consists of a total of 4.4ha and the quarry void is not worked anymore so groundwater has now found its rest level at 50mOD. The topography of the upper surface of the application site slopes from west to east and ranges from ~120mOD to ~104mOD.

The quarry was worked to a depth of approximately 130m below ground level. Pumped discharge from this 'north quarry' was subject to Donegal County Council Discharge Licence LWAT41. Another discharge licence exists for the main quarry (LWAT 48).

2. Data Sources

2.1 Site specific data included the following:

i. Topographic surveying (October 2014) supplied by the Applicant.

ii. Walk over inspection of the Site by Dr. Pamela Bartley, Hydro-G, 30th October 2014. During this site visit groundwater in the void, the discharge management mechanisms from the existing working area and local area water features were evaluated.

iii. Discharge and water quality monitoring results record as per Discharge Licence.

2.2 Regional Scale Data Evaluated

1. Soils Teagasc	Database 2007 (Digital)
2. Subsoil Geology	Teagasc Database 2007 (Digital)
3. Solid Geology	GSI Bedrock Geology, Geological Memoirs and Digital Database. Bedrock map Series Sheet 3 – South Donegal (1:100,000).
4. Aquifer Classification	GSI Draft bedrock and gravel aquifer maps 2014
5. Elevation	OSI Discovery Mapping 1:50,000
6. Hydrogeology	Local area hydrogeological information as determined from i. O'Neill GWE 2008 EIS for the site. ii. GSI description of the Groundwater Body iii. Donegal County Council data, iv. National Federation of Group Water Schemes; and v. Roadstone Quarry record (Northstone (NI) Ltd, Ballynacarrick Quarry, Ballintra, Co. Donegal.)

2.3 Fieldwork

The fieldwork undertaken as part of the hydrological and hydrogeological characterisation comprised a walkover survey of the site and surrounding area by hydrogeologist Dr. Pamela Bartley on the 30th October 2014. Pamela determined that groundwater level and groundwater ingress zones were readily identifiable and accessible in the application area by virtue of the excavation in existence. Therefore, the installation of monitoring wells was not necessary. During this site visit, Hydro-G interviewed the quarry manager and collected groundwater samples. The wider catchment area was reviewed by visual inspection, as were surface water features.

3. Setting the Location Context

As previously stated, the geographical setting and discharge mechanisms have previously been described by ONeill Groundwater Engineering (2008) and that work's detail remains valid for the site location and geographical setting. Therefore, I do not intend to repeat it in this section. However, the following points are worth stating again:

- The GSI suggests that the application site is underlain by the Donegal-Ballintra Groundwater Body (GWB). This is a "Regionally Important Aquifer" Rk which is karstified but dominated by diffuse rather than flow.
- Overall, groundwater flow directions are to the west. Groundwater moves in the direction of the coast and discharges to the sea. The coast is 5km west, approximately.
- The GWB report, prepared by the GSI, states that the "Limestones are generally over 100 m thick. Most groundwater is thought to flow in an epikarst layer 2-3 m thick, and in a zone of interconnected, solutionally-enlarged fissures and conduits that extends approximately 30 m below this. There will also be a zone of isolated, poorly connected fissures – typically less than 150 m below ground level".
- "The flow regimes in diffusely karstified aquifers are likely to be hydraulically connected, resulting in continuous water tables that reflect topography. As the groundwater flow is thought to be mainly unconfined, surface water is also likely to be in hydraulic continuity with the aquifer, especially where subsoil deposits are thin and/or permeable".
- There are no local Source Protection Areas identified on the GSI and EPA maps.
- The vulnerability rating is "X", meaning that the vulnerability is extreme because bedrock is at or near the surface.
- The WFD Groundwater Status is "good" but the Risk Score is 1b ("Possibly at risk of not achieving good status").

3.1 Groundwater Recharge

The GSI suggests that groundwater recharge in general area is 201 -250mm/yr.

3.2 Karst Features

The aquifer is classified as Karstified but it is diffuse rather than conduit. Therefore, there will be relatively fewer karst features at the surface or indeed mapped by the GSI. Only one karst feature is mapped in the vicinity of the quarry. This is an 'enclosed depression, which is mapped at ~500m to the NE of the quarry. This is not a significant karst feature.

The density of mapped features supports the 'diffuse flow' characterisation of the aquifer by the GSI.

The majority and most significant mapped karst features are recorded in the vicinity of Cavangarden (over 3km to the south of Mc Caffrey's quarry and these features lie within a distinctly different groundwater body that is the Ballyshannon GWB.

There is a spring and cave mapped karst features at 1km to the southeast of the quarry. They are associated with an un-named watercourse in the catchment area of the Ballintra River. Further karst features (springs and caves) are observed in the main Ballintra Valley, some 2 km to the northeast of the quarry.

3.3 Groundwater Levels

Groundwater level at other locations in the catchment (Ballynacarrick Quarry) suggest that groundwater is ~ 60m OD at a distance of 1km more inland. Given the relative geographical context of the quarry at McCaffrey's and its topographical surroundings, between the Ballynacarrick quarry and the coast, I would envisage natural groundwater levels to be ~ 50m OD.

3.4 Groundwater Quality

Groundwater samples were collected during the 30th October 2014 site visit by Dr. Pamela Bartley. Samples were collected from the groundwater body in the application area (north quarry void) and the groundwater sump in the working quarry during site visit on the 30th October 2014. The two samples were analysed for hydrochemical parameters in an accredited laboratory (CLS, Rosmuc, Co. Galway).

Groundwater Quality at the site complies with Groundwater Regulation Threshold Value Ranges (Table 1 & Certificates of Analysis presented in Appendix A). In general, ammonia levels are relatively low, as are other nutrient concentrations; sulphate is elevated in the main working area but remains compliant with the Groundwater Regulations. Overall, groundwater quality at both monitoring locations complies with legislative requirements. While there are small detections of Diesel Range organics (142 ug/l in the north quarry and 157 ug/l in the main quarry) the micro gram unit and the fact that the signal is not a 'known pattern' for the laboratory's library of 'fingerprints' for organics – it means that the signal is not an oil or diesel or petroleum product. Rather it is a natural organic.

Therefore, I deem the groundwater in the application area to be uncontaminated in status.

Table 1 Groundwater Quality Data October 2013

Sampled 30/10/2014	GW-North Quarry.		GW-Main Quarry	Units
Ammonia as N	0.012		0.034	mg/l
Calcium, total	165		128	mg/l
Chloride	24.5		17.6	mg/l
Conductivity @20C	509		443	uS/cm
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	142 *Unknown Pattern		157 *Unknown Pattern	ug/l
Iron, total	<10		<10	ug/l
Magnesium, total	39		13	mg/l
Manganese, total	<5		<5	ug/l
Nitrate as NO3	0.886		3.17	mg/l
Nitrite as NO2	<0.017		0.154	mg/l
Orthophosphate as PO4-P	<0.01		<0.01	mg/l
Potassium, total	5		8	mg/l
Sodium, total	16		15	mg/l
Sulphate	19.4		149	mg/l
Total Hardness (Kone)	84.8		205	mg/l CaCO3
CLS ID	553027		553026	

3.5 Local Abstractions

The GSI list a borehole located upon the farmland to the southeast of the Ballynacarrick quarry. This is incorrectly mapped: it should in fact be positioned within the car park at the Ballynacarrick quarry office. The borehole was drilled in 2001 and it was proved to have a sustainable yield of 380 m3/day (not 1,090 m3/day as was originally reported to the GSI).

Three boreholes are shown in the Glasbolie-Ballymagrorty area. These were "dug wells", yielding 20-35 m3/day. Allowing for poor locational accuracy (to the nearest 1000 m), the minimum distance from the quarry is 500m.

The GWB report, prepared by the GSI, refers to a "Good Well at Ballymagrorty" (yielding 109 m3/day). While the rEIS for Ballynacarrick Quarry (1.5 km to the NE) suggests that this "Good Well at Ballymagrorty" is most likely located within McCaffrey's quarry, my interviews with site management at McCaffrey's quarry confirmed that they were unaware of any boreholes on site or local boreholes.

During my site visit (October 2014), no boreholes were identified at local Properties.

The canteen and washroom facilities on Site are reliant upon the local water Scheme.

Donegal county council confirmed that *"there is no Public Water Supply Source in Ballintra. Ballintra village is supplied via the Donegal Town Lough Eske Public Water Supply. There is a small Lake Source in Ballymagroarty which supplies the Ballymagroarty Group Water Scheme, there has been no history of this lake suffering from any hydrological issues".* (Mr. Adrian O DONNELL [mail:AODONNEL@Donegalcoco.ie].

3.6 Designated Sites

The following Natura 2000 and NHA sites that occur within 5km of the north quarry

i. Ballintra SAC (000115)
ii. Carricknahorna Lough NHA (002068)
iii. Durnesh Lough SAC, pNHA (000138)
iv. Durnesh Lough SPA (004145)
v. Donegal Bay SPA (004151)
vi. Lough Golagh and Breesy Hill SAC (002164)
vii. Donegal Bay (Murvagh) SAC, pNHA (000139)

The ecological details of these sites are detailed in the ecological section.

I have considered the hydrological links between the quarry and the above listed sites. I present my considerations of potential impacts in Section 6.

Other local catchment features include a discontinued landfill and another quarry at Ballynacarrick, 1km to the north west, approximately.

3.7 Wastewater Treatment & Discharge

Wastewater generated on site is treated by a secondary wastewater treatment system and discharged to a percolation area in the vicinity of the offices/maintenance yard/building.

4. Discharges from the Quarry

Discharge from the north quarry ceased in 2013. The discharge was subject to Donegal county council discharge licence LWAT41 (2008). Details of the Discharge Characteristic stipulated in the Licence were presented by O'Neill (2008) as Follows:

Parameter	Main Quarry (L WAT 48)	North Quarry (L WAT 41)
Suspended solids (mg/l)	20	20
pH	6 - 9	6 - 9
Total Phosphates as P (mg/l)	0.5	0.5
Ammonia as N (mg/l)	5	5
Aluminimum (mg/l)	0.2	0.2

Monitoring results for the discharge are presented in Table 2. It is clear that the requirements of the discharge licence were adhered to from a hydrochemical perspective. The Discharge Licence (LWAT 41) stipulates a maximum volume of discharge of 30m3/hr (720 m3/d) (O Neill GWE, 2008). Monitoring data for discharge volume suggests compliance with this limit (Appendix B).

Table2 North Quarry Discharge

LWAT 41 - Discharge Point					
Parameter	**Total Aluminium**	**Ammonia as N**	**pH**	**Suspended Solids**	**Total Phosphorus as P**
Unit	**µg/l**	**mg/l**	**pH Units**	**mg/l**	**mg/l**
Jan-10	53	0.024	7.6	3	0.024
Feb-10	<20	<0.05	7.8	5	0.06
Mar-10	23	0.015	7.8	2	0.055
Apr-10	<20	0.012	7.8	2	0.08
May-10	<20	0.006	7.9	2	0.07
Jun-10	Visual Inspection - Dry				
Jul-10	120	0.009	7.6	<2	<0.05
Aug-10	44	0.599	8.1	<2	<0.05
Sep-10	92	0.021	7.8	<2	<0.05
Oct-10	23	0.053	10	<2	<0.05
Nov-10	69	<0.005	7.8	4	<0.05
Dec-10	91	0.044	8	<2	<0.05
Jan-11	16	0.079	7.9	7	<0.05
Feb-11	88	<0.005	7.3	6	<0.05
Mar-11	60	0.016	7.4	9	<0.05
Apr-11	4	<0.005	7.8	<2	<0.05
May-11	129	0.023	7.7	6	<0.05
Jun-11	35	0.043	7.6	<2	<0.05
Jul-11	26	0.018	8.1	<2	<0.05
Aug-11	38	0.036	7.4	<2	<0.05
Sep-11	Sampling Point Dry				
Oct-11	<2	2.7	7.4	2	<0.05
Nov-11	32	0.018	7.2	4	<0.05
Dec-11	39	0.008	7.5	<2	<0.05
Jan-12	<2	0.013	7.5	<2	<0.05
Feb-12	<2	0.739	7.9	2	<0.05
Mar-12	<2	0.041	7.9	<2	<0.05
Apr-12	6	0.162	8.1	<2	<0.05
May-12	3	0.127	7.9	<2	<0.05
Jun-12	3	0.268	8.2	<2	<0.05
Jul-12	<2	0.014	7.2	4	<0.05
Aug-12	6	1.89	7.8	<2	<0.05
Sep-12	6	<0.005	7.2	28	<0.05
Oct-12	7	0.02	7.4	<2	<0.05
Nov-12	74	0.014	7	14	<0.05
Dec-12	<2	0.018	7.5	2	<0.05
Jan-13	83	0.059	7.2	<2	<0.05
Feb-13	3	<0.005	7.6	3	<0.05
Mar-13	<2	0.013	7.7	<2	<0.05
Apr-13	3	0.137	8.0	5	<0.05
May-13	<2	3.44	7.7	<2	<0.05
Jun-13	8	0.234	7.6	11	<0.05
Jul-13	Visual Inspection - Discharge Point was Dry				
Aug-13	Quarry Section Closed				
Sep-13	Quarry Section Closed				
Oct-13	Quarry Section Closed				
Nov-13	Quarry Section Closed				
Dec-13	Quarry Section Closed				

Figure 1 Geographical context, location of discharge points and sampling points for McCaffrey quarry.

5. Receptor Monitoring

Monitoring Results are available for upstream and downstream locations in the vicinity of the quarry and the immediate discharge point and these are presented in Table 3.

Monitoring Results are available for multiple locations in Durnesh Lough and these are presented in Table 4.

It is clear from the data that Regulatory parameters are complied with most of the time (Surface Water Regulations 2009): two anomalous results presented for ortho-P – one of these was a downstream result in January 2013 and the other was for the upstream monitoring point in April 2013. Therefore, it may have been sediment or catchment influences. If the pattern was repeated it might raise questions, but the pattern never repeated.

Table 3 Upstream and Downstream Monitoring Point data (see Figure 1)

Upstream & Downstream						
Parameter	**Total Aluminium**	**Ammonia as N**	**Orthophosphate as PO4-P**	**Total Phosphorus as P**	**pH**	**Suspended Solids**
Unit	**µg/l**	**mg/l**	**mg/l**	**mg/l**	**pH Units**	**mg/l**
Mar-10						
Upstream	65	<0.005	<0.01	0.021	7.8	<2
Downstream	52	0.007	<0.01	0.016	7.7	<2
Jul-10						
Upstream	27	0.013	0.012	<0.05	8.2	3
Downstream	56	0.025	0.019	<0.05	8.1	10
Oct-10						
Upstream	26	0.055	<0.01	<0.05	9.8	<2
Downstream	30	0.062	<0.01	<0.05	9.7	<2
Jan-11						
Upstream	12	<0.005	<0.01	7.6	<2	<0.05
Downstream	27	<0.005	<0.01	7.9	<2	<0.05
May-11						
Upstream	41	0.026	<0.01	8	6	<0.05
Downstream	31	0.027	<0.01	7.9	3	<0.05
Oct-11						
Upstream	47	0.069	<0.01	7.9	6	0.06
Downstream	33	0.071	<0.01	7.8	<2	0.07
Jan-12						
Upstream	<2	0.469	<0.01	<0.05	7.7	<2
Downstream	<2	0.5	<0.01	<0.05	7.7	<2
Apr-12						
Upstream	20	0.013	<0.01	<0.05	8.2	2
Downstream	13	<0.005	<0.01	<0.05	8.5	<2
Jul-12						
Upstream	39	<0.005	0.018	<0.05	7.9	6
Downstream	37	<0.005	<0.01	<0.05	8	2
Nov-12						
Upstream	73	0.083	<0.01	<0.05	7.5	9
Downstream	22	0.01	<0.01	<0.05	7.3	12
Jan-13						
Upstream	42	0.079	<0.01	0.05	7.7	<2
Downstream	12	0.064	0.023	0.08	7.9	9
Apr-13						
Upstream	12	0.025	0.22	<0.05	7.8	3
Downstream	16	0.11	0.014	<0.05	8.3	<2
Oct-13						
Upstream	4	0.008	<0.01	<0.05	7.8	18
Downstream	3	<0.005	<0.01	<0.05	7.8	6
Nov-13						
Upstream	10	0.15	<0.01	0.08	7.8	5
Downstream	6	0.008	<0.01	<0.05	7.9	<2

Table 4 Durnesh Lough Monitoring data (see Figure 1)

Durnesh Lough						
Parameter	**Total Aluminium**	**Ammonia as N**	**Orthophosphate as PO4-P**	**Total Phosphorus as P**	**pH**	**Suspended Solids**
Unit	**µg/l**	**mg/l**	**mg/l**	**mg/l**	**pH Units**	**mg/l**
Mar-10						
Sampling Point 1	60	<0.005	<0.01	0.017	7.8	<2
Sampling Point 2	53	<0.005	<0.01	0.02	7.8	<2
Sampling Point 3	57	<0.005	<0.01	0.025	7.8	<2
Jul-10						
Sampling Point 1	<20	0.462	<0.01	<0.05	8.4	3
Sampling Point 2	39	0.038	0.035	0.08	8	2
Sampling Point 3	38	0.042	0.036	0.08	7.9	2
Oct-10						
Sampling Point 1	23	0.049	<0.01	<0.05	9.8	<2
Sampling Point 2	23	0.055	<0.01	<0.05	9.7	13
Sampling Point 3	24	0.053	<0.01	<0.05	9.8	<2
Dec-10						
Sampling Point 1	Visual Inspection - No Access to Lake					
Sampling Point 2	Visual Inspection - No Access to Lake					
Sampling Point 3	Visual Inspection - No Access to Lake					
Jan-11						
Sampling Point 1	19	<0.005	<0.01	<0.05	7.2	3
Sampling Point 2	38	0.041	<0.01	<0.05	7.6	21
Sampling Point 3	17	0.043	<0.01	<0.05	7.9	<2
May-11						
Sampling Point 1	107	0.017	<0.01	<0.05	7.9	<2
Sampling Point 2	26	0.02	<0.01	<0.05	7.9	6
Sampling Point 3	42	0.012	<0.01	<0.05	7.9	4
Oct-11						
Sampling Point 1	44	2.56	<0.01	<0.05	7.1	<2
Sampling Point 2	48	2.76	<0.01	<0.05	7.1	<2
Sampling Point 3	93	2.64	<0.01	<0.05	7.2	<2
Jan-12						
Sampling Point 1	6	0.011	<0.01	<0.05	7.5	<2
Sampling Point 2	10	0.015	<0.01	<0.05	7.5	<2
Sampling Point 3	8	0.014	<0.01	<0.05	7.5	<2
Apr-12						
Sampling Point 1	6	<0.005	0.04	0.05	8.5	19
Sampling Point 2	9	<0.005	0.011	<0.05	8.5	3
Sampling Point 3	10	0.029	<0.01	<0.05	8.4	8
Jul-12						
Sampling Point 1	<2	3.09	<0.01	<0.05	8.1	6
Sampling Point 2	<2	3.06	<0.01	<0.05	8.1	<2
Sampling Point 3	<2	3.1	<0.01	<0.05	8.1	<2
Nov-12						
Sampling Point 1	18	<0.005	<0.01	<0.05	7.7	<2
Sampling Point 2	63	<0.005	<0.01	<0.05	7.6	5
Sampling Point 3	19	<0.005	<0.01	<0.05	7.6	<2
Jan-13						
Sampling Point 1	12	0.033	<0.01	<0.05	8.1	74
Sampling Point 2	66	<0.005	<0.01	0.06	8.0	6
Sampling Point 3	77	0.008	<0.01	0.06	8.0	<2
Apr-13						
Sampling Point 1	7	0.014	<0.01	<0.05	8.3	24
Sampling Point 2	3	0.074	<0.01	0.07	8.5	26
Sampling Point 3	2	0.274	<0.01	<0.05	8.4	3
Oct-13						
Sampling Point 1	<2	0.009	<0.01	<0.05	7.9	4
Sampling Point 2	<2	<0.005	<0.01	<0.05	7.9	3
Sampling Point 3	<2	0.04	0.015	<0.05	7.9	<2
Nov-13						
Sampling Point 1	<2	0.079	<0.01	0.05	8.0	19
Sampling Point 2	12	0.094	0.01	0.07	7.9	23
Sampling Point 3	7	0.161	0.018	0.07	7.9	15

6. Hydrological & Hydrogeological IMPACT Assessment

As previously stated, abstraction and dewatering has ceased in the application area and groundwater levels in the quarry void now represent groundwater status. Due to the fact that groundwater levels are obvious and accessible, as are the faces of the excavation that might show groundwater ingress points, I suggest that it is not necessary to access groundwater by borehole drilling. I am assessing the environment on the basis of observations made at the site in October 2014 and other local information relating to piezometer installations at the Ballynacarrick quarry.

8.1 *Groundwater*

- For the purpose of this assessment, the pre-quarrying groundwater level is taken to be *circa* 50 m OD: based on piezometer data from Ballynacarrick quarry[1], proximity to the coast, sea level and relative location of Mc Caffrey's quarry.

- The final excavated floor level across the void of the McCaffrey Quarry application area is inferred to be -10 m OD, given the site information supplied suggesting that the void was worked to a depth of approximately 130m below ground level.

- I observed groundwater seepage coming in at ~52m OD at one location near the end point of the roadway to the void.

- Pumping to keep the void dry would have depressed groundwater levels by up to 50 m. As previously stated, local experience of this groundwater regime suggests that quarrying dewatering causes a steep-sided cone of depression but the overall radius of groundwater lowering is shown to be of limited lateral extent (Quarry Plan, 2013; Ballynacarrick Quarry, Ballintra). Thus, the localised lowering of groundwater level within the sump probably had a very limited radius of influence upon the diffuse fissure system in this type of limestone strata. Evidence of karst conduits, sinking and re-emerging streams have been proved by tracer tests at the Ballynacarick Quarry. No evidence of karst features or conduits were identified by observations at the site by Dr. Pamela Bartley nor during interview with Site Management at Mc Caffrey's quarry.

- Recent hydrogeological assessments for the quarry 1.5 km, approx, to the north east (Now Roadstone, previously Northstone (NI) Limited, Ballintra Quarry, Ballinacarraig, Co. Donegal (see Remedial EIS, 2013) provides a characterisation of negligible impact of quarrying outside quarry boundaries in this Regionally Important Aquifer – Karstified (Rk) aquifer and associated bedrock type.

- [1] The pre-quarrying groundwater level is taken to be *circa* 62-63 maOD at the Ballynacarrick, Quarry 1.5 km to NE), which has floor level across the majority of its void currently maintained at 46-47 maOD, it is inferred that groundwater level in the quarry sump is suppressed by up to 16 m as a result of pumping activities. In the event that quarry dewatering operations would be terminated and the quarry void would fill with water to form a lake, it is considered that a lake level of some 62-63 maOD (subject to seasonal variation) would be established within the abandoned workings. **Reference**: Quarry Plan, 2013; Ballynacarrick Quarry, Ballintra.

- Local experience of the groundwater regime suggests that quarrying dewatering causes a steep-sided cone of depression but the overall radius of groundwater lowering is shown to be of limited lateral extent (Quarry Plan, 2013; Ballynacarrick Quarry, Ballintra). Thus, the localised lowering of groundwater level within the sump has a very limited radius of influence upon the diffuse fissure system in the limestone strata.

- In conclusion, there is no currently observed negative hydrogeological impact arising from quarrying and dewatering at the site, which has now ceased. There is no observable impact on either the quantity of groundwater nor the quality of groundwater. Groundwater levels have returned to expected values and groundwater quality reflects an unimpacted groundwater. Yes, the groundwater body is now exposed. However, good site management will mitigate risk.

8.2 Surface Water

- The flow regime in the local streams is not considered to have been impacted by the quarry dewatering operation. Review of historical monitoring data suggests overall compliance with environmental obligations as specified by Regulatory Standards.

- Any waters encountered in the application area north quarry were discharged under Discharge Licence (LWAT 41). Discharges complied with the standards specified in the Discharge Licence (LWAT41) issued by Donegal County Council. This provides protection against the risk of flow or quality derogation in the surface water regime downstream from the Site.

8.3 SAC's

- It is considered that the radius of groundwater lowering at the Ballynacarrick Quarry, Ballintra has not extended beneath Ballintra SAC (limestone pavement), which is adjacent to the Ballynacarrick Quarry, Ballintra (ref: Quarry Plan, 2013 rEIS). Therefore, it is unlikely that any groundwater lowering at the application site caused any impact on the Ballintra SAC given that the application site is ~1.5 – 2 km to the south west of the Ballintra SAC.

- With respect to Durnesh Lough SAC, while it was hydrologicaly connected to the quarry's historical discharge, it is not a receiver now. In any case, the monitoring of the Lough associated with the Discharge Licence LWAT 41 suggests no negative impact on Durnesh Lough, from a water quality perspective.

- I do not consider there to be potential for the quarry to have negatively impacted any of the sites listed in Section 3.6, from a hydrological or hydrogeological perspective.

- Overall, Patrick McCaffrey & Sons Ltd. operates in line with an Environmental Management System compiled for the quarry and with relevant guideline documents. Environmental monitoring is undertaken on a regular basis which includes dust and water monitoring. Monitoring is dealt with in relevant sections of the rEIS.

- My assessment is undertaken without the benefit of any predevelopment groundwater level data or quantification of seasonal variations directly at the site.

However, there is a historical record for a local site (Ballynacarrick Quarry, 1.5km to the NE). For future reference, data collected during the summer and autumn months would inform an assessment of the void's flood level characteristic. However, I deem this to be academic because we know the current rest level of the groundwater body at the McCaffrey Quarry application area and this current level corresponds with the natural expected groundwater level. Therefore, any possible historical effect of dewatering or cones of depression are deemed to have been temporary and inconsequential.

Appendix A = CLS Certificates of Analysis

Appendix B = Site monitoring data for discharge volumes from North Quarry

Annex = ONeill Groundwater Report 2008

Project No.:	09328_McCaffreys
Report Title:	McCaffreys Quarry, Co. Donegal - Hydrological & Hydrogeological Assessment 2014
Report Status:	Issue
Date:	23rd November 2014

Prepared by:

_____

Dr. Pamela Bartley B.Eng, MSc., Ph.D

Hydro-G

pamela@hydro-g.com

50 Henry St.
Galway

Appendix A

CLS Certificates of Analysis 2014

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Dr. Pamela Bartley
HYDRO-G
50 Henry Street
Galway
Galway

Report No. : 243368
Date of Receipt : 31/10/2014
Start Date of Analysis : 31/10/2014
Date of Report : 20/11/2014
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
553027	GW-North Quarry, 30/10/14	Conductivity @20C	R	509	uS/cm
		Sodium, total	R	16	mg/l
		Chloride	R	24.5	mg/l
		Nitrate as NO3	R	0.886	mg/l
		Nitrite as NO2	R	<0.017	mg/l
		Iron, total	R	<10	ug/l
		Potassium, total	R	5	mg/l
		Total Hardness (Kone)	R	84.8	mg/l CaCO3
		Magnesium, total	R	39	mg/l
		Sulphate	R	19.4	mg/l
		Orthophosphate as PO4-P	R	<0.01	mg/l
		Ammonia as N	R	0.012	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	165	mg/l
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	142 *Unknown Pattern	ug/l

* Note: The comment expressed here is an interpretation and is not INAB accredited

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Dr. Pamela Bartley
HYDRO-G
50 Henry Street
Galway
Galway

Report No. : 243367
Date of Receipt : 31/10/2014
Start Date of Analysis : 31/10/2014
Date of Report : 20/11/2014
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
553026	GW-Main Quarry. 30/10/14	Conductivity @20C	R	443	uS/cm
		Sodium, total	R	15	mg/l
		Chloride	R	17.6	mg/l
		Nitrate as NO3	R	3.17	mg/l
		Nitrite as NO2	R	0.154	mg/l
		Iron, total	R	<10	ug/l
		Potassium, total	R	8	mg/l
		Total Hardness (Kone)	R	205	mg/l CaCO3
		Magnesium, total	R	13	mg/l
		Sulphate	R	149	mg/l
		Orthophosphate as PO4-P	R	<0.01	mg/l
		Ammonia as N	R	0.034	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	128	mg/l
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	157 *Unknown Pattern	ug/l

* Note: The comment expressed here is an interpretation and is not INAB accredited

Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Conductivity @20C	CLS 67	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes	No	No
Nitrite as NO2	Konelab CLS 37	Yes	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Total Hardness (Kone)	Konelab CLS 77	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
553027	GW-North Quarry. 30/10/14	Good condition	30/10/2014

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Appendix B

Site monitoring data for discharge volumes from North Quarry

Appendix B – North Quarry Discharge Volumes

LWAT 41 - North Quarry 2011

2011	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P
	CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES	
1			**122820**	**2450**			153837	1785			181010	**1213**	**196769**	**1957**	209598	1120								
2					138616	1215			165695	2111							221806	511						
3	**105679**	**1725**	124187	**1367**	139166	550									210948	1350					238657	1050	247952	1334
4									167015	1320			198978	**2209**					230913	1085				
5															212314	1366								
6	**107435**	**1756**									183450	**2440**					223591	1785						
7			126609	**2422**	141416	2250							200413	**1435**					232268	1355	239616	959	249006	1054
8							155692	1855			184685	**1235**			214379	2065								
9									169105	2090							224144	553						
10	109784	**2349**	128064	**1455**	143346	1930					187030	**2345**			215679	1300								
11													201824	**1411**					233392	1124				
12							156882	1190	170845	1740					216919	1240							250088	1082
13	111239	**1455**									188430	**1400**												
14			130394	**2330**													224991	847			240841	1225		
15					145486	2140	158020	1138					203567	**1743**										
16									173236	2391					218673	1754							252108	2020
17	**113535**	**2296**	132362	**1968**							190093	**1663**							234663	1271				
18					147536	2050	160087	2067	174238	1002											242000	1159		
19													204897	**1330**			226013	1022						
20											191273	**1180**												
21	115612	**2077**	133862	**1500**															235923	1260			253298	1190
22							161578	1491			193408	**2135**									243852	1852		
23					149906	2370									220038	1365	227630	1617						
24			135213	**1351**					176601	2363									236847	924				
25	118368	**2756**											205947	**1050**							245174	1322		
26																							254634	1336
27									178082	1481	194812	**1404**	207203	**1256**										
28	120370	**2002**	137401	**2188**			163584	3497									228806	1176	237607	760				
29					152052	2146							208478	**1275**	221295	1257					246618	1444		
30									179797	1715							229828	1022					255632	998
31																								

M.R - METER READING **W.P - WATER PUMPED** **CHECKED BY: SEAMUS MOLLOY**

LWAT 41 - North Quarry 2012																								
2012	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P
	CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES	
1			**272205**	2429	**287368**	**1750**					333692	**1813**									420977	1186		
2													352332	1960	370947	1890			404178	2292				
3			273311	1106			300821	1491	317081	1659														
4	**257508**	**1876**															389232	2100					440162	2,555
5											335837	**2145**	354495	2163					406175	2001				
6			274742	1431	289804	**2436**	302431	1610													422867	1890		
7											337193	**1356**			373302	2355	390877	1645					442115	1,953
8									319092	2011									407957	1778				
9	259223	**1715**			291197	**1393**							356210	1715							424564	1697		
10			276719	1977			304401	1970							375396	2094							444091	1,976
11									321097	2005	339625	**2432**					393099	2222						
12																			410270	2313				
13	261624	**2401**					305937	1536			340900	**1275**	358264	2054	377072	1676	394019	920			426716	2152	446057	1,966
14			278784	2065	293402	**2205**																		
15									323267	2170	342196	**1296**							411498	1228				
16	**263680**	**2056**					307666	1729					360084	1820	379150	2078					428809	2093		
17			280698	1914	294704	**1302**											396248	2229					448091	2,034
18									324887	1620									413521	2023				
19											344457	**2261**												
20	266060	**2380**					309829	2163					362254	2170	380742	1592	397924	1676			431192	2383		
21			282119	1421	296191	**1487**																	450604	2,513
22									327025	2138	346144	**1687**							415561	2040				
23							311376	1547													433268	2076		
24	267736	**1676**	283655	1536	297808	**1617**							364655	2401	382915	2173								
25									328775	1750	347922	**1778**					400080	2156	417565	2004				
26																					435091	1823		
27	269776	**2040**					313574	2198			348972	**1050**	366653	1998									453208	2,604
28			285618	1963	299330	**1522**			330143	1368					385281	2366	401886	1806						
29											350372	**1400**												
30							315422	1848					369057	2404					419791	2226	437607	2516		
31									331879	1736					387132	1851							455357	2,149

MR = Meter Reading

WP = Water Pumped

LWAT 41 - North Quarry 2013																								
2013	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Date	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P
	CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES	
1	24577	584			33425	275			73998	271														
2							37112	513																
3									74389	391	78516	218												
4	24979	402	28624	623	33779	354																		
5							37540	428																
6			29117	493					74772	383														
7					34110	331					78930	414												
8							38001	461	75101	328														
9			29624	507																				
10					34416	306			75472	371	79172	242												
11	25598	619					38372	371																
12					34749	333																		
13			30235	611					75910	438														
14	26010	412																						
15					35179	430	38839	467																
16			30827	592					76415	505														
17																								
18	26630	620			35449	270																		
19			31417	590			39314	475																
20									77025	610														
21	27214	584																						
22			32014	597	35834	385	39679	365																
23									77316	291														
24																								
25	27909	695	32570	556																				
26					36235	401	40079	400																
27			33150	580					77941	625														
28	28511	602																						
29					36599	364	40399	320																
30									78298	357														
31	28001	510																						

MR = Meter Reading

WP = Water Pumped

Annex O Neill Groundwater Report (2008)

APPENDIX 8-2

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client	:	Pat O'Donnell Earth Science Partnership Ltd. Buckwaria Road, Tonranny, Westport Co. Mayo	Report No.	:	293913
			Date of Receipt	:	28/04/2016
			Start Date of Analysis	:	28/04/2016
			Date of Report	:	12/05/2016
			Order Number	:	
CC	:	Marie Mc Devitt, McCaffrey's Quarry	Sample taken by	:	CLS

Lab No	Sample Description	Test	*	Result	Units
671554	EI027 McCaffrey's Discharge point 1.	Suspended Solids	R	<2	mg/l
		pH	R	7.4	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Ammonia as N	R	<0.005	mg/l
		Aluminium, Total	R	8	ug/l

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671554	EI027 McCaffrey's Discharge point 1.	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client	:	Pat O'Donnell Earth Science Partnership Ltd. Buckwaria Road, Tonranny, Westport Co. Mayo	Report No. Date of Receipt Start Date of Analysis Date of Report Order Number	: : : : :	293914 28/04/2016 28/04/2016 12/05/2016
CC	:	Marie Mc Devitt, McCaffrey's Quarry	Sample taken by	:	CLS

Lab No	Sample Description	Test	*	Result	Units
671555	EI027 McCaffrey's Discharge point 2.	Suspended Solids	R	13	mg/l
		pH	R	7.6	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Ammonia as N	R	0.009	mg/l
		Aluminium, Total	R	50	ug/l

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671555	EI027 McCaffrey's Discharge point 2.	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 293917
Date of Receipt : 28/04/2016
Start Date of Analysis : 28/04/2016
Date of Report : 12/05/2016
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	*	Result	Units
671557	EI027, Mc Caffrey's, Durnesh Lake, Downstream	Suspended Solids	R	<2	mg/l
		pH	R	7.5	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Orthophosphate as PO4-P	R	0.014	mg/l
		Ammonia as N	R	<0.005	mg/l
		Aluminium, Total	R	7	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671557	EI027, Mc Caffrey's, Durnesh Lake, Downstream	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client	:	Pat O'Donnell Earth Science Partnership Ltd. Buckwaria Road, Tonranny, Westport Co. Mayo	Report No.	:	293918
			Date of Receipt	:	28/04/2016
			Start Date of Analysis	:	28/04/2016
			Date of Report	:	12/05/2016
			Order Number	:	
CC	:	Marie Mc Devitt, McCaffrey's Quarry	Sample taken by	:	CLS

Lab No	Sample Description	Test	*	Result	Units
671558	Mc Caffrey's, Lake sample 1	Suspended Solids	R	<2	mg/l
		pH	R	7.6	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Orthophosphate as PO4-P	R	0.012	mg/l
		Ammonia as N	R	0.009	mg/l
		Aluminium, Total	R	9	ug/l

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671558	Mc Caffrey's, Lake sample 1	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client	:	Pat O'Donnell Earth Science Partnership Ltd. Buckwaria Road, Tonranny, Westport Co. Mayo	Report No.	:	293919
			Date of Receipt	:	28/04/2016
			Start Date of Analysis	:	28/04/2016
			Date of Report	:	12/05/2016
			Order Number	:	
CC	:	Marie Mc Devitt, McCaffrey's Quarry	Sample taken by	:	CLS

Lab No	Sample Description	Test	*	Result	Units
671559	Mc Caffrey's, Lake sample 2	Suspended Solids	R	<2	mg/l
		pH	R	7.6	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Orthophosphate as PO4-P	R	<0.01	mg/l
		Ammonia as N	R	0.009	mg/l
		Aluminium, Total	R	8	ug/l

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671559	Mc Caffrey's, Lake sample 2	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client	:	Pat O'Donnell Earth Science Partnership Ltd. Buckwaria Road, Tonranny, Westport Co. Mayo	Report No.	:	293916
			Date of Receipt	:	28/04/2016
			Start Date of Analysis	:	28/04/2016
			Date of Report	:	12/05/2016
			Order Number	:	
CC	:	Marie Mc Devitt, McCaffrey's Quarry	Sample taken by	:	CLS

Lab No	Sample Description	Test	*	Result	Units
671560	Mc Caffrey's, Lake sample 3	Suspended Solids	R	<2	mg/l
		pH	R	7.5	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Orthophosphate as PO4-P	R	0.012	mg/l
		Ammonia as N	R	0.005	mg/l
		Aluminium, Total	R	10	ug/l

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671560	Mc Caffrey's, Lake sample 3	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 293915
Date of Receipt : 28/04/2016
Start Date of Analysis : 28/04/2016
Date of Report : 12/05/2016
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	*	Result	Units
671556	EI027, Mc Caffrey's, Durnesh Lake, Upstream	Suspended Solids	R	<2	mg/l
		pH	R	7.5	pH Units
		Total Phosphorus as P	R	<0.05	mg/l
		Orthophosphate as PO4-P	R	0.025	mg/l
		Ammonia as N	R	0.006	mg/l
		Aluminium, Total	R	9	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.
* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

Test	Specification	CLS 17025 status	GMP/FDA[1]	ISO[2]	Sub[3]	Sub 17025 Status
Suspended Solids	CLS 13	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Total Phosphorus as P	CLS 151	Yes	No	Yes	No	No
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Ammonia as N	Konelab CLS 40	Yes	No	Yes	No	No
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes	No	No

[1]Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
[2]Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).
[3]Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
671556	EI027, Mc Caffrey's, Durnesh Lake, Upstream	Good condition	28/04/2016

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

PT 1
PT 2
PT 3
DOWNSTREAM
UPSTREAM
DISCHARGE POINT
Durnesh Lake
Inishfad
Dromhome
Dromoske
Horse Hill
Moneymore
Connors Bridge
Inishinny
Birra Hill
Dromore Hill
Raneeny Hill
Dromore
Birra
Drumeneel
Ballymagrorty Scotch
Rossnowlagh Lower
Durnesh Hill
Durnesh
Foyagh Hill
Foyagh Br.
Carrigfad
Rathfragan
Ballymagrorty Irish
Glasbolie Hill
Crockahanny
Megalithic Tomb
Belall Strand
Rossnowlagh
Ros Neamhlach
Killinangel Hill
Lurgan Lower
Hillfort
147
Cairn
Glasbolie
Killinangel
Ardeelan Hill
Megalithic Tomb
Lurgan
Pollnaleaghy
Ardeelan
Rosscat
Rosscat Hill
Oughtnashammer
Blue Stairs
Coolmore
Tullyokey
Tullyoogan
Tullyesky
Tummoge
Alla
Lurgan Upper
Coolbeg Hill
Megalithic Tomb
Cashel Hill
Corker
Tullycar
Laheen Hill
Ardpattan L.
Tullynamaskin
Standing Stone
Kilbarron
Cashel
Twomilestone
Turanulty
Kistonag
R231
N15

APPENDIX 8-3

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No.	:	353295
Date of Receipt	:	25/01/2018
Start Date of Analysis	:	25/01/2018
Date of Report	:	01/02/2018
Order Number	:	
Sample taken by	:	CLS

Lab No	Sample Description	Test	Ref.	Result	Units
836404	EI027 McCaffrey's Discharge point 1.	Suspended Solids	I, R	<2	mg/l
		pH	I, R	6.5	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	<0.005	mg/l
		Aluminium, Total	I, R	13	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling and Food Safety Monitoring are all ISO 9001 certified (Rosmuc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
836404	EI027 McCaffrey's Discharge point 1.	Good condition	25/01/2018

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 362837
Date of Receipt : 29/05/2018
Start Date of Analysis : 29/05/2018
Date of Report : 08/06/2018
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	Ref.	Result	Units
866750	EI027 McCaffrey's Discharge point 1.	Suspended Solids	I, R	2	mg/l
		pH	I, R	7.2	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.016	mg/l
		Aluminium, Total	I, R	5	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Susie McGuinness

Susie McGuinness
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling and Food Safety Monitoring are all ISO 9001 certified (Rosmuc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
866750	EI027 McCaffrey's Discharge point 1.	Good condition	29/05/2018

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 369836
Date of Receipt : 28/08/2018
Start Date of Analysis : 28/08/2018
Date of Report : 07/09/2018
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
890286	EI027 McCaffrey's Discharge point 1.	Suspended Solids	I, R	<2	mg/l
		pH	I, R	7.3	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.148	mg/l
		Aluminium, Total	I, R	9	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Susie McGuinness

Susie McGuinness
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling and Food Safety Monitoring are all ISO 9001 certified (Rosmuc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
890286	EI027 McCaffrey's Discharge point 1.	Good condition	28/08/2018

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 374998
Date of Receipt : 30/10/2018
Start Date of Analysis : 30/10/2018
Date of Report : 06/11/2018
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	Ref.	Result	Units
906742	EI027 McCaffrey's Discharge point 1.	Suspended Solids	I, R	<2	mg/l
		pH	I, R	7.6	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.006	mg/l
		Aluminium, Total	I, R	25	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling and Food Safety Monitoring are all ISO 9001 certified (Rosmuc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
906742	EI027 McCaffrey's Discharge point 1.	Good condition	30/10/2018

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No.	:	379683
Date of Receipt	:	08/01/2019
Start Date of Analysis	:	08/01/2019
Date of Report	:	23/01/2019
Order Number	:	
Sample taken by	:	CLS

Lab No	Sample Description	Test	Ref.	Result	Units
922694	EI027 McCaffrey's Discharge point 1.	Suspended Solids	I, R	<2	mg/l
		pH	I, R	7.5	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.008	mg/l
		Aluminium, Total	I, R	26	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
922694	EI027 McCaffrey's Discharge point 1.	Good condition	08/01/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 386196
Date of Receipt : 02/04/2019
Start Date of Analysis : 02/04/2019
Date of Report : 09/04/2019
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
943068	EI027 McCaffrey's Discharge	Suspended Solids	I, R	11	mg/l
		pH	I, R	8.0	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.012	mg/l
		Aluminium, Total	I, R	44	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
943068	EI027 McCaffrey's Discharge	Good condition	02/04/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 398686
Date of Receipt : 11/09/2019
Start Date of Analysis : 11/09/2019
Date of Report : 25/09/2019
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
985654	EI027 McCaffrey's Discharge 1 South Quarry	Suspended Solids	I, R	<2	mg/l
		pH	I, R	7.3	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.011	mg/l
		Mileage: €0.45 per km	R	ok	per mile
		Aluminium, Total	I, R	28	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by:

AnnMarie Nee
Environmental
Services Administrator

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Mileage: €0.45 per km		No	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
985654	EI027 McCaffrey's Discharge 1 South Quarry	Good condition	11/09/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No.	:	405581
Date of Receipt	:	06/12/2019
Start Date of Analysis	:	06/12/2019
Date of Report	:	13/12/2019
Order Number	:	
Sample taken by	:	CLS

Lab No	Sample Description	Test	Ref.	Result	Units
1010544	EI027 McCaffrey's Discharge	Suspended Solids	I, R	4	mg/l
		pH	I, R	7.6	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.005	mg/l
		Aluminium, Total	I, R	27	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by:

AnnMarie Nee
Environmental
Services Administrator

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.
CLS will test food, water and swabs samples within 24 hours of receipt.
Where samples have been taken by the Client, results apply to the samples as received.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1010544	EI027 McCaffrey's Discharge	Good condition	06/12/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 398687
Date of Receipt : 11/09/2019
Start Date of Analysis : 11/09/2019
Date of Report : 25/09/2019
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
985655	EI027 McCaffrey's Discharge 2 North Quarry	Suspended Solids	I, R	<2	mg/l
		pH	I, R	8.4	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Ammonia as N	I, R	0.016	mg/l
		Mileage: €0.45 per km	R	ok	per mile
		Aluminium, Total	I, R	10	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by:

AnnMarie Nee
Environmental
Services Administrator

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Mileage: €0.45 per km		No	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
985655	EI027 McCaffrey's Discharge 2 North Quarry	Good condition	11/09/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 391856
Date of Receipt : 17/06/2019
Start Date of Analysis : 17/06/2019
Date of Report : 09/07/2019
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	Ref.	Result	Units
963362	EI027, Mc Caffrey's, Durnesh Lake, Upstream	Suspended Solids	I, R	10	mg/l
		pH	I, R	8.0	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Orthophosphate as PO4-P	I, R	<0.01	mg/l
		Ammonia as N	I, R	<0.005	mg/l
		Aluminium, Total	I, R	63	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
963362	EI027, Mc Caffrey's, Durnesh Lake, Upstream	Good condition	17/06/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

CERTIFICATE OF ANALYSIS

Client : Pat O'Donnell
Earth Science Partnership Ltd.
Buckwaria Road, Tonranny,
Westport
Co. Mayo

Report No. : 391857
Date of Receipt : 17/06/2019
Start Date of Analysis : 17/06/2019
Date of Report : 09/07/2019
Order Number :
Sample taken by : CLS

Lab No	Sample Description	Test	Ref.	Result	Units
963363	EI027, Mc Caffrey's, Durnesh Lake, Downstream	Suspended Solids	I, R	5	mg/l
		pH	I, R	8.0	pH Units
		Total Phosphorus as P	I, R	<0.05	mg/l
		Orthophosphate as PO4-P	I, R	<0.01	mg/l
		Ammonia as N	I, R	<0.005	mg/l
		Aluminium, Total	I, R	54	ug/l

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 108T

Approved by: Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.
This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
est. is an estimated count.

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

Complete Laboratory Solutions
[Tel] 091 574355
[Fax] 091 574356
[Email] services@cls.ie
[web] www.cls.ie

In-House Test	Specification	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Total Phosphorus as P	CLS 151	Yes	No	Yes
Orthophosphate as PO4-P	Konelab CLS 35	Yes	No	Yes
Ammonia as N	Konelab CLS 40	Yes	No	Yes
Aluminium, Total	ICP-MS CLS129	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
963363	EI027, Mc Caffrey's, Durnesh Lake, Downstream	Good condition	17/06/2019

Complete Laboratory Solutions,
Ros Muc, Connemara,
Co. Galway

Complete Laboratory Solutions,
MedPharma Division,
Unit 3a, Small Business Park, Mervue, Galway

Symbol Reference - I:17025 accredited; S:Subcontracted; R:Analysis carried out in Ros Muc; M:Analysis carried out in MedPharma

TEST REPORT NO: 195572 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/03/1643
Quote Ref: QM005175
Order No: N/A
Sales Order: 101816
Date Received: 15/03/2021
Date Sampled: 15/03/2021
Date Completed: 20/03/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 1

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		20/03/2021	BHP AC 012
pH		pH Units	7.25		15/03/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 22/03/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 195572 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/03/1644
Quote Ref: QM005175
Order No: N/A
Sales Order: 101816
Date Received: 15/03/2021
Date Sampled: 15/03/2021
Date Completed: 20/03/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 2

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<10		20/03/2021	BHP AC 012
pH		pH Units	8.25		15/03/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 22/03/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 201317 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/06/3204
Quote Ref: QM005175
Order No: N/A
Sales Order: 109368
Date Received: 18/06/2021
Date Sampled: 18/06/2021
Date Completed: 23/06/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 1

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		23/06/2021	BHP AC 012
pH		pH Units	7.86		18/06/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 24/06/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 201317 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/06/3205
Quote Ref: QM005175
Order No: N/A
Sales Order: 109368
Date Received: 18/06/2021
Date Sampled: 18/06/2021
Date Completed: 23/06/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 2

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		23/06/2021	BHP AC 012
pH		pH Units	8.29		18/06/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 24/06/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 207696 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/09/3705
Quote Ref: QM005175
Order No: N/A
Sales Order: 117823
Date Received: 20/09/2021
Date Sampled: 20/09/2021
Date Completed: 22/09/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 1

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		22/09/2021	BHP AC 012
pH		pH Units	7.89		20/09/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 27/09/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 207696 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/09/3706
Quote Ref: QM005175
Order No: N/A
Sales Order: 117823
Date Received: 20/09/2021
Date Sampled: 20/09/2021
Date Completed: 22/09/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 2

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<10		22/09/2021	BHP AC 012
pH		pH Units	8.30		20/09/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 27/09/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 211115 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/11/3323
Quote Ref: QM005175
Order No: N/A
Sales Order: 122630
Date Received: 17/11/2021
Date Sampled: 17/11/2021
Date Completed: 19/11/2021
Sample Type: Surface Water

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 1

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		19/11/2021	BHP AC 012
pH		pH Units	7.56		17/11/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 22/11/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~ :	Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation

TEST REPORT NO: 211115 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/11/3324
Quote Ref: QM005175
Order No: N/A
Sales Order: 122630
Date Received: 17/11/2021
Date Sampled: 17/11/2021
Date Completed: 19/11/2021
Sample Type: Surface Water

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Quarterly_Surface Water
Client Ref: Discharge Point 2

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		19/11/2021	BHP AC 012
pH		pH Units	8.22		17/11/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 22/11/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation

TEST REPORT NO: 211115 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/11/3326
Quote Ref: QM005175
Order No: N/A
Sales Order: 122631
Date Received: 17/11/2021
Date Sampled: 17/11/2021
Date Completed: 19/11/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Upstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<10		19/11/2021	BHP AC 012
pH		pH Units	7.94		17/11/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 26/11/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation

BHP/AC/F115v2

TEST REPORT NO: 211115 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 21/11/3327
Quote Ref: QM005175
Order No: N/A
Sales Order: 122631
Date Received: 17/11/2021
Date Sampled: 17/11/2021
Date Completed: 24/11/2021
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Downstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<5		24/11/2021	BHP AC 012
pH		pH Units	8.03		17/11/2021	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 26/11/2021

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation

Patrick McCaffrey & Sons Ltd. - Ballymagroarty Irish, Ballintra, Co Donegal.

2021 - LWAT 41 - DISCHARGE - NORTH QUARRY		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
March	<5	7.25
June	<10	7.86
September	<5	7.89
November	<5	7.56

Patrick McCaffrey & Sons Ltd. - Ballymagroarty Irish, Ballintra, Co Donegal.

2021 - LWAT 48 - DISCHARGE - SOUTH QUARRY		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
March	<10	8.25
June	<5	8.29
September	<10	8.3
November	<5	8.22

Patrick McCaffrey & Sons Ltd. - Ballymagroarty Irish, Ballintra, Co Donegal.

2022 - LWAT 48 - DISCHARGE - SOUTH QUARRY		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
14.02.2022	<5	7.57
19.04.2022	7.6	7.35
20.09.2022	<5	7.79
18.10.2022	<10	7.54

2022 - LWAT 41 - DISCHARGE - NORTH QUARRY		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
14.02.2022	<10	7.92
19.04.2022	<5	7.91
20.09.2022	<10	7.96
18.10.2022	<5	8.08

2022 - Upstream & Downstream		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
18.10.2022		
Upstream	<10	7.7
Downstream	<10	7.92

Patrick McCaffrey & Sons Ltd. - Ballymagroarty Irish, Ballintra, Co Donegal.

2021 - LWAT 41 - DISCHARGE - NORTH QUARRY		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
March	<5	7.25
June	<5	7.86
September	<5	7.89
November	<5	7.56

Patrick McCaffrey & Sons Ltd. - Ballymagroarty Irish, Ballintra, Co Donegal.

2021 - Upstream & Downstream		
Parameter	**Suspended Solids**	**pH**
Limit	**20**	**6.0 - 9.0**
Unit	**mg/l**	**pH Units**
November		
Upstream	<10	7.94
Downstream	<5	8.03

TEST REPORT NO: 190175 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 20/11/2500
Quote Ref: QM005175
Order No: N/A
Sales Order: 94850
Date Received: 16/11/2020
Date Sampled: 16/11/2020
Date Completed: 18/11/2020
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Upstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test	Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids Acc.	mg/L	<5		18/11/2020	BHP AC 012
pH	pH Units	7.76		16/11/2020	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 19/11/2020

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 190175 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 20/11/2501
Quote Ref: QM005175
Order No: N/A
Sales Order: 94850
Date Received: 16/11/2020
Date Sampled: 16/11/2020
Date Completed: 18/11/2020
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Downstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<10		18/11/2020	BHP AC 012
pH		pH Units	7.68		16/11/2020	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 19/11/2020

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
^ Potable water matrix
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory. Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.

TEST REPORT NO: 236744 .1

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 22/10/3308
Quote Ref: QM005175
Order No: N/A
Sales Order: 154992
Date Received: 18/10/2022
Date Sampled: 18/10/2022
Date Completed: 22/10/2022
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Upstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

Test		Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids	Acc.	mg/L	<10		22/10/2022	BHP AC 012
pH		pH Units	7.70		18/10/2022	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 24/10/2022

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation
BHP Laboratory's decision rule: When we report a statement of compliance, we base it on the actual result of the test compared to the standard being used, regardless of the uncertainty

BHP/AC/F115v2

TEST REPORT NO: 236744 .2

Client: Patrick McCaffrey and Sons l
Ballymagroarty
Ballintra
Co. Donegal

BHP Ref. No: 22/10/3309
Quote Ref: QM005175
Order No: N/A
Sales Order: 154992
Date Received: 18/10/2022
Date Sampled: 18/10/2022
Date Completed: 22/10/2022
Sample Type: Surface Water

FTAO: Marie McDevitt
Site: Ballymcgroarty Quarry
BHP Ref: Annually_Surface Water
Client Ref: Downstream

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

Test	Units	Results	Customer Limits	Date Analysed	Method
Total Suspended Solids Acc.	mg/L	<10		22/10/2022	BHP AC 012
pH	pH Units	7.92		18/10/2022	BHP AC 067

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 24/10/2022

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

This test report shall not be duplicated except in full and then only with the permission of the test laboratory.
Results apply only to the sample tested and where the laboratory is not responsible for sampling, result apply to the sample as received.
Information identifying the 'Client', 'FTAO', 'Site', 'Client Ref', 'Order No' and 'Date Sampled' where BHP have not taken the sample has been supplied by the customer.
Sampling is outside the scope of accreditation
BHP Laboratory's decision rule: When we report a statement of compliance, we base it on the actual result of the test compared to the standard being used, regardless of the uncertainty

Pt 1
Pt 2
Pt 3
Pt 4
Downstream
Upstream
Point No. 1
Discharge Point
Lwat 41
Point No. 2
Discharge Point
Lwat 48
Application Site
Durnesh Lake
Inishinny
Dromore
Drumeneel
Rossnowlagh
Lower
Durnesh
Rathfragan
Crockahanny
Rossnowlagh
Ros Neamhlach
Killinangel
Lurgan
Lower
Lurgan
Ardeelan
Coolmore
Tullyokey
Tullyoogan
Rosscat
Tullyesky
Oughtna-
shammer
Tullaghelvin
Ballymagrorty
Glasbolie
Hill
Kiclane Hill
Ballynacarrick
Belall Strand
Megalithic
Tomb
Megalithic
Tomb
Megalithic
Tomb
Bunlin Bar
Drumlongfield
Dromhome
Dromoske
Lacklom
Tobernahoory
Moneymore
Raneeny Hill
Drumnacroil
Ballintra
Baile an
Aghadullag
Aghad
Br.
Connor's
Br.
Drumoske
Br.
Foyagh
Hill
Foyagh
Br.
Birra
Birra L.
Dromore Hill
Dismantled Railway
R231
Belall Strand
Ardeelan Hill
Killinangel
Hillfad
Lough
Gorman
Tummoge
Drumnashan
Alla
Coolbeg
Megalithic
Tomb
Gillin
Megalithic
Tomb
Garvanagh
Garve
Hill
Ballyna
Hill
Abhainn
Bhaile
Ballintra
River
Stratha
Drumoske
Br.
Drumoske
Horse
Hill
Lismintan or
Ballintra
Baile an
Loughtone
Hill
Barrow
Ch
Inishfad
Dromhome
Lough
Durnesh
Foyagh
Hill
Foyagh
Br.
Dismantled Railway
Glasbolie
Hill
Glasbolie
Hill
Hillfad
Lurgan
Lurgan
Rosscat
Hill
Tullyesky
Oughtna-
shammer
Laheen
Tullaghelvin
Lurgan
Ballynacarrick
Kiclane Hill
Garvanagh
Garve
Hill
Ballyna
Hill
Lough
Gorman
Tummoge
Drumnashan
Megalithic
Tomb
Megalithic
Tomb
Megalithic
Tomb
Gillin
Megalithic
Tomb
Belall Strand
Ardeelan Hill
Killinangel
Hillfad
Rossnowlagh
Lower
Durnesh
Rathfragan
Crockahanny
Rossnowlagh
Ros Neamhlach
Killinangel
Lurgan
Lower
Lurgan
Ardeelan
Coolmore
Tullyokey
Tullyoogan
Rosscat
Tullyesky
Oughtna-
shammer
Tullaghelvin
Ballymagrorty
Glasbolie
Hill
Kiclane Hill
Ballynacarrick

APPENDIX 8-4

EARTH SCIENCE PARTNERSHIP

O'Neill
ground water engineering

Report

Environmental Impact Statement – Geology, Soil And Water Sections For A Proposed Quarry Extension At P.Mc Caffrey And Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

June 2008

PROJECT NO. : 0170801

ALL COMMUNICATIONS RELATED TO THIS DOCUMENT SHOULD BE DIRECTED TO

O'Neill Ground Water Engineering,
Unit D5,
M7, Business Park,
Newhall,
Naas,
Co. Kildare
info@groundwatereng.ie

Tel: 045-895668
Fax: 045-881705

O'Neill
ground water engineering

ENVIRONMENTAL IMPACT STATEMENT - GEOLOGY AND SOIL SECTION FOR A PROPOSED QUARRY EXTENSION AT P.MC CAFFREY AND SONS LTD, BALLYMAGRORTY, BALLINTRA, CO. DONEGAL

INTRODUCTION

1.1 This Section deals with the geology (Bedrock and Quaternary) and soils components of the EIS for the quarry at Ballymagrorty, Ballintra, Co. Donegal and addresses the impacts of the proposed quarrying activities on the geology and soils.

1.2 The study area examined in this report is shown in *Figure No. 1.1.* The existing quarry is situated on the west side of the N15 National Primary route from Ballyshannon to Donegal. The proposed extension is further west to the existing quarry, located south west of the village of Ballintra and is accessed by a local road, which extends westwards off a cut section of the N15.

1.3 The site is divided into two parts (refer to *Figure No. 1*) and includes two quarry excavations. The main quarry (existing quarry) with all fixed plants and the second is an additional excavation area which is called the 'north quarry'.

1.4 The extension area known as 'North Quarry' is in operation for more than 20 years. Currently excavation takes place in the northern part of the quarry north of the local road dividing the quarry site. There is no fixed plant in this site and is used for the excavation of rock and transportation to the main quarry for processing. The northern quarry site is proposed to be extended to the south of the local road.

1.5 The two sites combined have an approximate rectangular shape, elongated from west to east. The site is 5.83 Ha in area and the proposed quarry extension area comprises approximately 1.89 Ha.

1.6 The proposed quarry south of the local road is currently used as agricultural land and the boundaries of the site are also marked by agricultural land.

1.7 The coordinates of the quadrant in which the proposed quarry area is located are as follows:

Co-ordinate Point	National Grid Reference
X – Minimum	190495
X - Maximum	190767
Y - Minimum	367494
Y - Maximum	367638

1.8 All relevant data was compiled and collated by O'Neill Ground Water Engineering Ltd. (OGE) from data sourced at the Geological Survey of Ireland (GSI), Donegal County Council and from Earth Science Partnership Ltd.

1.9 OGE has assessed and compiled information and background data on the bedrock and Quaternary geology, and soils of the proposed quarry at Ballymagrorty during a desk study of the area. OGE has visited the site during a walk-over survey on the 31st of January and 1st of February 2008.

REFERENCES

Details of the references reviewed and/or quoted are presented below:

Lee, M., Daly, D., 2005. County Donegal Ground Water Protection Scheme, Volume II.

Ordnance Survey Of Ireland, Discovery Series, Map 11

Geological Survey of Ireland, Geology of South Donegal, Sheet 3

THE EXISTING ENVIRONMENT

Topography

1.10 The landscape in and around the proposed area comprises of undulating lands. There are hills existing to the sides of the quarry viz., Glasbolie hill (127m), Kilelane Hill (132m), Laheen Hill (106m). The quarry boundary is at a higher elevation compared to the immediate surrounding areas (*Figure No. 1.1*).

1.11 West of the site some streams flows in a north westerly direction and discharges to the Durnesh Lake, which is located 2.3km from the site. Further west to the Durnesh Lake is the Donegal Bay. In

southwest Donegal, the surface water generally drains to the west/southwest, into Donegal Bay. Between Ballyshannon and Ballintra, lakes and discontinuous stream segments are common features (Donegal Groundwater Protection Scheme, 2005).

1.12 The landscape around Donegal Bay is gentler than that to the north for two main reasons: the bedrock consists of relatively soft shales, sandstones and limestones; and, the area was one of Ice Age glacial deposition, so that drumlins and tills blanket the area (Geology of South Donegal, GSI, 1999). Fundamental controls on the Donegal landscapes were the interactions of rock structure and glaciation.

Bedrock geology

1.13 Details of the bedrock geology have been compiled from information obtained from the GSI, County Donegal Groundwater Protection Scheme and from the scoping document obtained from the Earth Science Partnerships Ltd. The map shown in *Figure No. 1.2* is principally underlain by what are defined as "Ballyshannon Limestone Formation" (Dinantian Pure Bedded Limestone Rock Group). The limestone is predominantly a medium to light grey, massively bedded crinoidal clacarenite. Stylolites are common and frequently give the only sense of bedding. Macrofossils are generally uncommon, although shelly horizons occur frequently.

1.14 Units of other lithologies are interspersed with the principal lithology, and allow some subdivision of the formation into Cherty Beds, Sandy Beds and Upper Argillaceous Limestone.

Structural Geology

1.15 The structural geology of the area shows the presence of two major faults in the vicinity of the site. The fault present approximately 750m to the south-east of the site has a NE-SW orientation.

1.16 The second fault is located approximately 1.5km to the south-west and has a NW-SE orientation. The faults intersect at approximately 2km south-west to the proposed quarry boundary.

Karstification

1.17 In Carboniferous Limestone dissolution by percolating rainwater that finds its ways down through cracks, joints or discontinuities in the bedrock often occur. This process is known as karstification. The karst features follow mainly the discontinuities in the rock, and can from voids and cavities underground through which ground water can flow rapidly and in other directions than can be discerned by topography only. The karstification process is strongly related to tectonic uplift and

subsequent erosion, and every successive period of karstification will cause further dissolution over the palaeokarst or fault patterns. In Ireland today the ground water levels are generally high so active karst formation is only occurring in limited geographical areas. Permeabilities in karstified areas are extremely variable, although they area highest in the upper more weathered part of the aquifer. This is referred to as *Epikarst.*

1.18 The Ballyshannon Limestone is a clean, karstified limestone. Karst features include several springs and caves such as the Pullaun caves near Ballintra. A brief karst mapping programme undertaken by the GSI in the Parkhill area in January 2005 for the preparation of Donegal Groundwater Protection scheme identified 27 features that comprised 12 springs, 8 enclosed depressions, 3 swallow holes, 2 areas of superficial solution ('karren'), 1 cave and 1 turlough (Donegal Groundwater Protection Scheme, 2005).

1.19 There are no karst features identified within the quarry boundary. Compiling data from the GSI with the Ordnance Survey 1:50,000 map the nearest karst feature exist approximately 2km south east to the site at Drumnasharragh and is identified as a spring (*Figure No. 1.2*).

Quaternary geology and soils

1.20 The quaternary period encompasses the last 1.6 million years and deals with the soils that were deposited over the bedrock described above. These deposits are shown in *Figure 1.3.* The Pleistocene (1.6 million years - 10.000 years ago) is commonly known as the last Ice Age, which was a period of intense glaciation separated by warmer inter-glacial periods. During the Holocene in which we live now the climate was warmer and wetter approaching that which we have today.

1.21 Glacial deposits resulting from this glaciation period are wide spread and are laid down in a wide range that differs in thickness, extent and lithology. The proposed quarry and the surrounding area are underlain by Ballyshannon Limestone Formation and overlying subsoil/soil thickness is <1m. The top soil is classified as shall well drained mineral soil derived mainly from calcareous parent materials.

1.22 The subsoil map of the area shown in *Figure No. 1.4* shows the presence of calcareous bedrock close to the surface.

1.23 Outside the quarry boundary, the subsoils include limestone till of Carboniferous age; metamorphic till and cutover pet.

Depth to Bedrock

1.24 The depth to bedrock (i.e. subsoil thickness) is a critical factor in determining ground water vulnerability. The direction of ice movement has spatially influenced the subsoil thickness. Generally, the thickness of overburden will be relatively thicker where eskers are formed, as these are deposited over till or sand and gravel. The Till and sand and gravel deposits vary in thickness.

1.25 Depth to bedrock at the site was estimated from the exposed quarry faces. Bedrock is present within 1 metre of the ground surface. Since there was no boreholes/borehole logs available for the site, OGE could not further assess the depth to bedrock condition at different places locations within the quarry boundary.

IMPACTS

Direct Impacts

1.26 The nature of the development will entail the removal and placement of soil and subsequent blasting and removal of rock. There will, therefore, be a direct and irreversible impact on the soil and existing rock.

Indirect Impacts

1.27 The development will not have an indirect impact on the geological aspects of the environment outside the footprint of the quarry. Hydro-geological impacts are addressed in the Water section of this EIS.

Positive Impacts

1.28 The proposed development of the quarry will supply fill material and aggregate for the local construction industry and will provide a benefit to the local community as it will provide local employment.

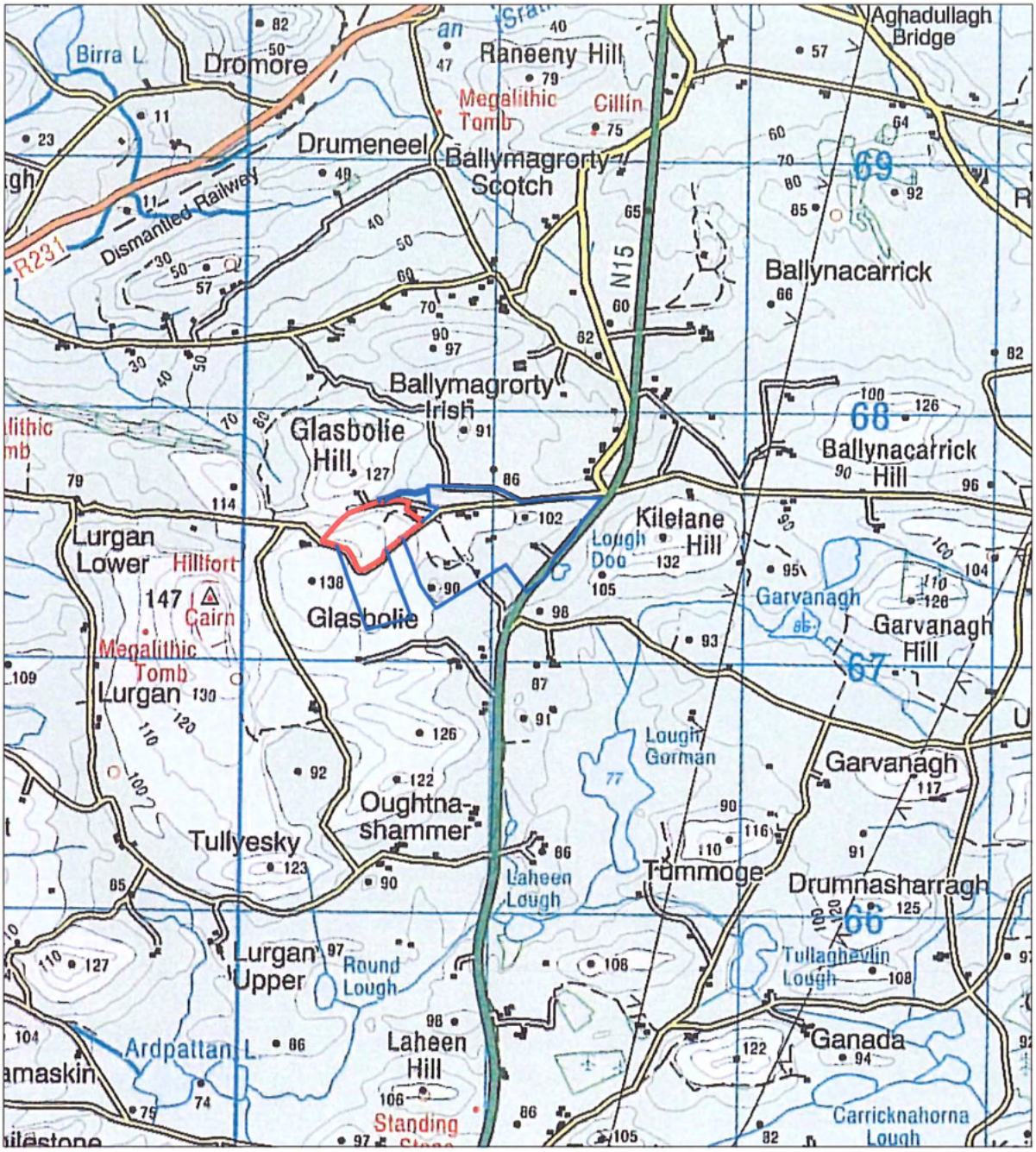
MITIGATION

Soils

1.29 The proposed extraction area will have a long term land take of 8.4 hectares. The overburden will be removed. This will partly be used to surround the excavation area to reduce the noise from the blasting and to minimise the impact of the excavation hole on the landscape.

Bedrock

1.30 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 quarry footprint. This cannot be undone.



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

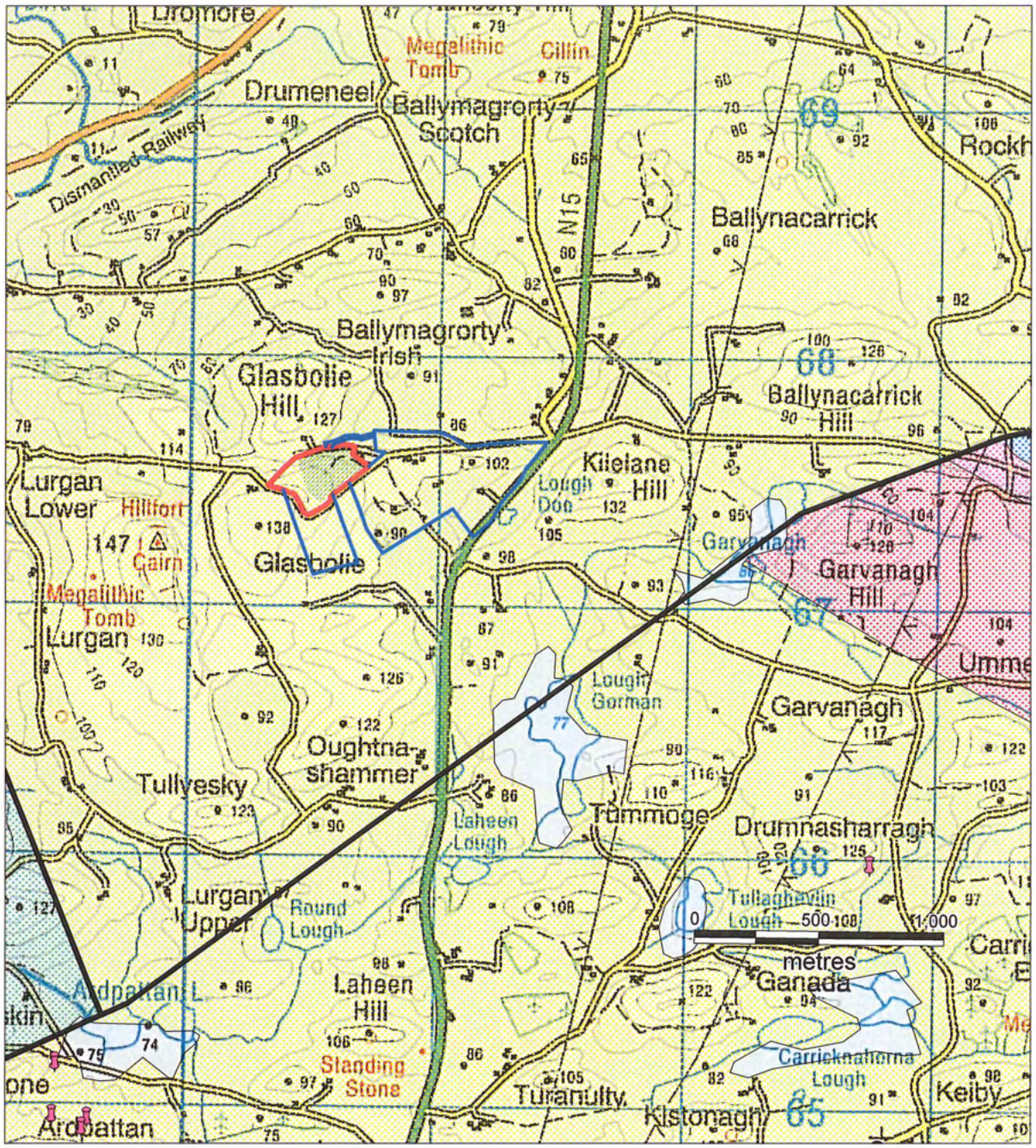
Client: Earthscience Partnership

Project: Geology & Soil Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Site Location

Key: Landholding Outline; Site Outline

Scale: 1:50,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 1.1
Drawn by: BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

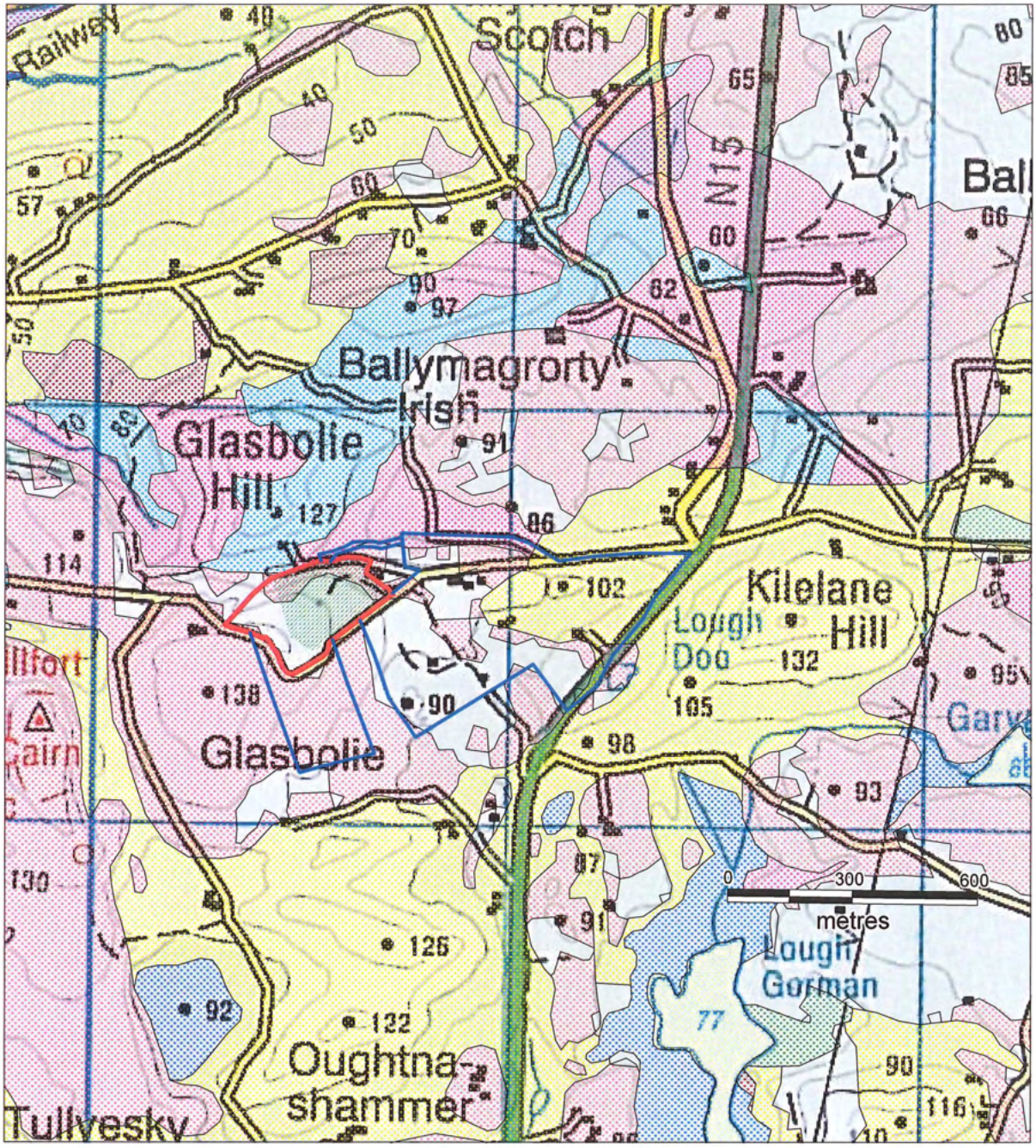
Client: Earthscience Partnership

Project: Geology & Soil Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Bedrock,Structural Geology and Karst Features

Key:
- Argillaceous limestone & calc. shale
- Pale grey calcarenite limestone
- Sandstone, siltstone & shale
- Fault
- Karst Feature

Scale: 1:25,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 1.2
Drawn by BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

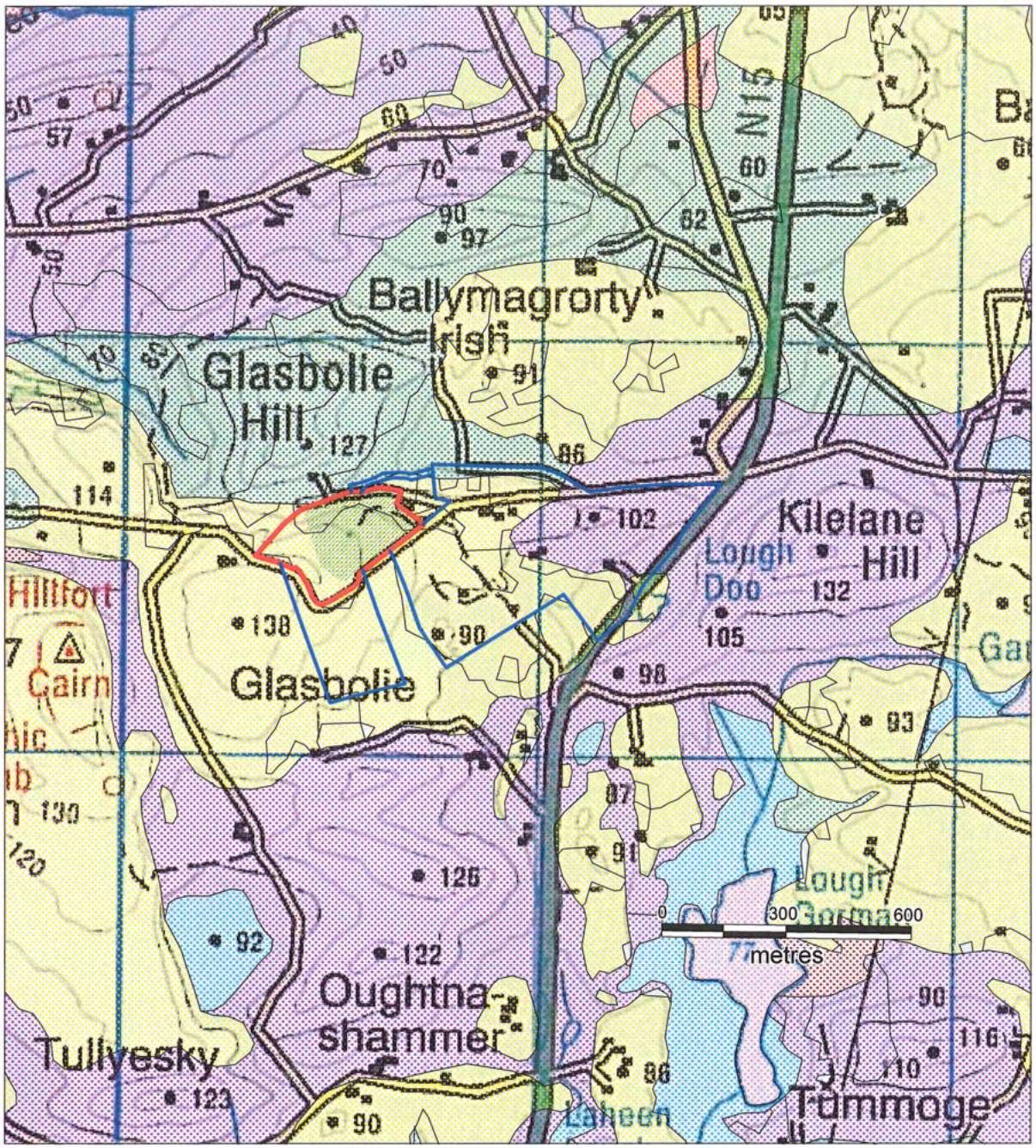
Client: Earthscience Partnership

Project: Geology & Soil Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Soil Map

Key:
- Deep well drained mineral Derived from mainly calcareous parent materials
- Deep well drained mineral Derived from mainly non-calcareous parent materials
- Shallow well drained mineral Derived from mainly calcareous parent materials
- Shallow, lithosolic or podzolic type soils potentially with peaty topsoil Predo
- Shallow, lithosolic or podzolic type soils potentially with peaty topsoil Predo

Scale: 1:15,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 1.3
Drawn by BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

Client: Earthscience Partnership

Project: Geology & Soil Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Subsoil Map

Key:
- Calcareous bedrock close to surface
- Cutover peat
- Limestone till (Carboniferous)
- Metamorphic till

Scale: 1:15,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 1.4
Drawn by BS	**Reference:** 0170801

O'Neill
ground water engineering

ENVIRONMENTAL IMPACT STATEMENT - WATER SECTION FOR A PROPOSED QUARRY EXTENSION AT P. MC CAFFREY AND SONS LTD, BALLYMAGRORTY, BALLINTRA, CO. DONEGAL

INTRODUCTION

2.1 This section deals the surface water and ground water components of the EIS for the quarry at Ballymagrorty, Ballintra, Co. Donegal and addresses the potential impacts for the continuation of the quarrying activities on those surface and ground waters. Where necessary, mitigation measures are also proposed. Landscape, soils and geology are dealt in a separate section.

2.2 The study area examined in this report is shown in *Figure No. 2.1.* The existing quarry is situated on the west side of the N15 National Primary route from Ballyshannon to Donegal. The proposed extension is further west to the existing quarry, located south west of the village of Ballintra and is accessed by a local road, which extends westwards off a cut section of the N15.

2.3 The site is divided into two parts (refer to *Figure No. 1*) and includes two quarry excavations. The main quarry (south quarry) with all fixed plants and the second is an additional excavation area which is indicated as 'north quarry'.

2.4 The extension area known as 'North Quarry' is in operation for more than 20 years. Currently excavation takes place in the northern part of the quarry north of the local road dividing the quarry site. The site is used solely for the excavation of rock and transportation to the main quarry for processing. The north quarry site is proposed to be extended to the south of the local road.

2.5 The two sites combined have an approximate rectangular shape, elongated from west to east. The site is 5.83 Ha in area and the proposed quarry extension area (north quarry) comprises approximately 1.89 Ha.

2.6 The proposed quarry extension south of the local road is currently used as agricultural land and the boundaries of the site are also marked by agricultural land.

2.7 The coordinates of the quadrant in which the quarry area is located are as follows:

Co-ordinate Point	National Grid Reference
X – Minimum	190495
X - Maximum	190767
Y - Minimum	367494
Y - Maximum	367638

2.8 The objectives of the Water Section of the EIS are to :

- Characterise the current hydrological and hydrogeological systems within the area of study;
- Assess the impact of the proposed development on the following:
  - Geology and soils in the context of the hydrogeology;
  - Surface water flows;
  - Surface water hydrochemistry and quality;
  - Ground water flows and local wells;
  - Ground water hydrochemistry and quality;
  - Management of water within the Section 261 application area;
  - Aquifer vulnerability, with regard to potential increases in vulnerability during operation of the proposed development and;
  - Resource protection
- Provide mitigation measures to minimise the potential impacts and maintain a good water quality status for all waters which may be potentially impacted upon by the continuation of the quarry.

SOURCES OF DATA

2.9 Background data on the site was compiled by OGE. Further information and data was collected on site by OGE during a field visit.

2.10 All other relevant data was compiled and collated by OGE, from data sourced at the Geological Survey of Ireland (GSI), Environmental Protection Agency (EPA), Ordnance Survey of Ireland (OSI) and Met Éireann.

METHODOLOGY

2.11 A desk study and analysis were conducted with data collected from the GSI. Data from EPA, Met Éireann and the OSI was also reviewed at the offices of OGE.

2.12 The site was visited by O'Neill Ground Water Engineering Ltd. (OGE) personnel on 31st of January and 1st of February 2008.

HYDROLOGY

Regional hydrology

2.13 In the vicinity of the existing quarry site and surrounding area the main surface water feature is Durnesh Lake which is situated 2.3km to the northwest. North east to the Durnesh Lake, there are three interconnected small lakes viz., Drumoske, Drumhome and Birra, which finally discharges into the Durnesh Lake. There are a few small streams which also discharge into the Durnesh Lake (see *Figure No. 2.1*). The nearest stream to the proposed quarry site is located approximately 300m west from the quarry boundary. This stream also discharges into the Durnesh Lake. There is a small lake (Lough Doo) located on the eastern side of the quarry across the N15 road.

2.14 The River Sratha flows in an east-west direction approximately 2.2km north to the quarry boundary and a tributary of the River discharges to the Dromoske Lough.

2.15 The latest (2005) biological river water quality of the Sratha River at Connor's Bridge gives a value of 3, showing poor status (EPA website).

Local hydrology

2.16 The surface water catchment in which the existing quarry is situated has a surface area of approximately 0.4 km^2, based on the topography of the surrounding area (*see Figure No. 2.2*).

2.17 The boundary of the existing quarry is situated on a topographic "high" such that the immediate land on all sides of the quarry is at a lower elevation relative to the quarry boundary. The proposed quarry area and the lands adjacent contribute surface run-off and ground water recharge to the catchment area.

Water Balance

2.18 Rainfall and evapotranspiration data were sourced from Met Éireann. The average annual rainfall (AAR), based on data from three rainfall stations nearest to the proposed quarry area, was determined to be 1161 mm (*Table No. 2.1*). The three rainfall stations are: Ballintra G.S, approximately 2.6km north-east of the site; Ballyshannon (Cathleen's fall), approximately 6.6km south-west of the site; Ballyshannon (Cherrymount), approximately 7km south of the site.

2.19 The closest synoptic station to the site is at Clones, approximately 75km south-east of the site. The average Potential Evapotranspiration (PE) for Clones is 438.8 mm/yr. This value is used as a best estimate of the site PE. Actual Evapotranspiration is estimated as 395 mm/yr (=0.9PE). The multiplication factor allows for the reduction in evapotranspiration during periods when a soil moisture deficit is present. The multiplication factor used by the GSI is equivalent to 0.95 (Water Framework Directive, 2004). OGE use a more conservative multiplication factor equal to 0.9. This results in more water having to be managed by the quarry.

Table No. 2.1: **30 year mean monthly rainfall data (in mm) supplied by Met Éireann (long term averages).**

Station		**Grid Ref.**		**Ht (mAOD)**		**Opened**		**Closed**				
Ballintra G.S.		*G918700*		*40*		*1948*		1991				
Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***July***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***	***Annual***
129	85	104	67	75	86	85	113	125	140	132	123	**1264**
Station		**Grid Ref.**		**Ht (mAOD)**		**Opened**		**Closed**				
Ballyshannon (Cathleen's fall)		*G884613*		*38*		*1945*		*0*				
Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***July***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***	***Annual***
109	75	88	57	68	74	73	99	103	118	111	107	**1082**
Station		**Grid Ref.**		**Ht (mAOD)**		**Opened**		**Closed**				
Ballyshannon (Cherry mount)		*G901604*		*30*		*1954*		*0*				
Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***July***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***	***Annual***
115	78	92	59	72	79	77	105	109	123	117	111	**1136**
										Average		**1161**

2.20 The Effective Rainfall (ER) for the site is determined from:

$$ER = AAR - AE.$$
$$= 1161 \text{ mm/yr} - 395 \text{ mm/yr}$$
$$\mathbf{ER = 766 \text{ mm/yr}}$$

2.21 The application area has bare rock and no vegetation. There will be no vegetation present on the quarry floor, and therefore no transpiration. This means that in reality there will be greater evaporation from exposed rock surfaces. Therefore the 766mm/yr effective rainfall represents an overestimate of the true amount of runoff and so is a worst case calculation.

2.22 The total quarry area is 33.82 hectares based on the ER value determined above, the volume that is available for runoff or recharged directly on the proposed application area to the quarry area is given by:

$$\text{Quarry application area run-off} = \text{Area} \times ER$$
$$= (338{,}200 \text{ m}^2)*(0.766 \text{ m/yr})$$
$$\mathbf{= 259{,}061 m^3/yr \ (709.7 \ m^3/d \text{ or } 8.2 \ l/s)}$$

2.23 The available water for run-off and recharge was calculated for the catchment area, current excavation area within the North Quarry and proposed excavation for the north quarry. These calculations are shown in *Table No. 2.2.*

Table No. 2.2: **Mean annual water balance for the defined topographic surface water catchment area.**

	1	2	3	4	5	6	7	8	9
Topographic surface area defined	**Area of catchment (m^2)**	**Area of sub-catchment (m^2)**	**Mean annual precipitation (mm)**	**Mean annual Potential Evaporation (mm)**	**Effective evaporation (mm)**	**Effective annual precipitation (mm) (3)-(5)**	**Annual volume of water moving into area (m^3)**	**Mean flow of water moving through area (m^3/s)**	**Annual ground water recharge (m^3) (85%)**
Surface catchment to the quarry	400,000		1161	438.8	395	766	306,400	0.01	260,440
North Quarry- current excavation area		39,400	1161	438.8	395	766	30,180	0.00095	25,653
North Quarry- proposed excavation		18,900	1161	438.8	395	766	14,477	0.00045	12,305

2.24 The proportion of the potential recharge that will reach the aquifer can be calculated using the method developed by the Geological Survey of Ireland for use in the Water Framework Directive *("Guidance On The Assessment Of The Impact Of Groundwater Abstractions"*, Guidance document GW5, Water Framework Directive, April 2004).

2.25 The proposed site is characterised by areas where rock is at ground surface. Geological Survey of Ireland (2004) state that extremely vulnerable aquifers, where rock is at ground surface, the recharge coefficient is given as 60 to 100% with an inner range 80-90%. A value of 85% was adopted for calculations. A summary of the water balance calculations is presented in *Table No. 2.2.*

2.26 It should be noted that the areas of the catchment area discussed above are based upon estimates of the topographic surface water catchment only. The surface water catchment area may under or over-estimate the ground water catchment area. As the area underlying the existing quarry consists of calcarenite limestone which could have an impact on the ground water flow velocities and directions. OGE have at all times assumed a worse case scenario (used the maximum/minimum values in a range that would pose the greatest potential for an adverse impact).

HYDROGEOLOGY

Geology in Context of Surface and Ground Water

2.27 Topography falls in all directions around the site boundary except west boundary *(refer Figure No. 2.2)*; away from the site indicating that the quarry boundary is at an elevated level compared to the immediate surrounding areas to the north, south and east. Hence there will be minimum ingress of surface water run off from the surrounding areas.

2.28 The study area is underlain by "Ballyshannon Limestone Formation". The limestone is predominantly a medium to light grey, massively bedded crinoidal clacarenite. Stylolites are common and frequently give the only sense of bedding. Macrofossils are generally uncommon, although shelly horizons occur frequently.

2.29 A significant consideration to the water environment is the depth to bedrock, which is an important factor in the vulnerability of the aquifer(s). The GSI vulnerability classification for the proposed area is Extreme (rock near surface or karst). Depth to bedrock on the site, estimated from the exposed quarry

face, is within 1m of the ground surface.

2.30 Within the extraction area, bedding and fissures were observed in the bedrock. Water ingress through fissures in the rock in the sides of quarry excavations was observed during the site visit. This indicates ground water ingress.

Aquifers and Aquifer Classifications

2.31 As shown in *Figure No. 2.3.*, the existing quarry lies on a regionally important karstified bedrock aquifer (**Rk**). This type of aquifer is characterised by thick bedded limestones which are generally highly fractured with abundant karst features. The rock group is Dinantian Pure Bedded limestone. The study area is underlain by "Ballyshannon Limestone Formation".

2.32 Karstification is the process whereby limestone is slowly dissolved away by percolating waters. It most often occurs in the upper bedrock layers and along certain fractures, fissures and joints. Karstification frequently results in the uneven distribution of permeability through the rock. The landscape is characterised by largely underground drainage, with most flow occurring through the more permeable, solute-enlarged, interconnected fissure/conduit zones. Groundwater often discharges as large springs which range from regular and dependable to highly variable.

2.33 OGE accessed the karst database of the GSI. The nearest karst feature exists approximately 2km south east to the site at Drumnasharragh and is identified as a spring. There is no karstification within the quarry or in the immediate area surrounding the existing quarry site meaning there are no pathways for rapid transfer of water to groundwater. Water flow was observed in fissures of the bedrock in the quarry excavations.

Aquifer Vulnerability

2.34 Ground water vulnerability is a measure of the risk that a potential ground water contamination event may have on the ground water beneath. It does not mean that contamination has occurred or will occur; but rather, it is a measure of how vulnerable ground water is to a potential contamination event. The vulnerability of ground water is a function of the nature of the overlying soil cover, the presence and the nature of the overburden, the nature of strata, and the depth of overburden above the water table.

2.35 The vulnerability of the Dinantian Upper Impure Limestones was obtained from ground water vulnerability data provided by the GSI. According to the GSI, the entire area is located in an area of extreme vulnerability due to shallow depth to bedrock (<1m). This leaves the limestone potentially susceptible to contaminants. The vulnerability map is shown in *Figure No. 2.4.*

Source Protection Zones

2.36 The closest source protection zone (for Ballyshannon Public Water Supply Scheme) is located south of the proposed site at Ballynaglogh (*Figure No. 2.5*). For Ballyshannon Public Water Supply Scheme, the entire Zone of Contribution (ZOC) is classified as the Inner Source Protection Area (SI). The minimum distance between the surface water catchment boundary and the inner source protection area is 2.5km.

2.37 The Source Protection Zone lies in a different surface water catchment. The quarry activity poses no potential risk to this source protection zone.

Special Areas of Conservation

2.38 The nearest Special Areas of Conservation are the Ballintra Hill (approximately 1.5km north-east) and the Durnesh Lough (approximately 2.5km north-west) to the proposed quarry boundary (*see Figure No. 2.1*). Ballintra hill is a low hill with almost bare limestone near the summit and scrub woodland on its sides. Areas of calcareous grassland also occur within the site. Durnesh Lough is a large, sedimentary lagoon, which is separated from the sea by a barrier that is composed partly of drumlins and partly high sand dunes with the remains of cobble barriers in places.

Third Party Wells Immediately Adjacent To Excavation Area

2.39 OGE has searched the GSI data base for the wells near the site (*Figure No. 2.6*). The wells near to the site have a location accuracy of 1km to 2km according to the GSI data base. According to local knowledge, all the houses in the immediate vicinity to the proposed quarry are connected to the mains. Hence the wells shown in the map would not be in use any more for portable water.

2.40 During the site visit, OGE has identified a well in a farm field adjacent to the quarry which is being used for cattle. However, OGE could not measure the level of water in the well due to lack of access.

Quarry Operation and Water Management

North Quarry

2.41 The north quarry floor is currently at approximately 40m O.D. The quarry acts as a local sump and is partially filled with water from a combination of surface and groundwater. There are two attenuation areas within the quarry. Water collected at the lowest attenuation area is pumped to the attenuation area located at a higher level (approximately 10m from the lowest level) using a 7KW submersible (6″) pump.

2.42 Water collected at this level is pumped at a maximum rate of 720m³/d using a 20KW submersible (6″) pump to a drain (head approximately 70m) outside the quarry boundary through a 9″ concrete pipe. This drain ultimately joins a small stream which in turn discharges into the Durnesh Lake. A schematic representation of the quarry water management is shown in *Figure No. 2.7*. This is based on the assumption that the excavation has not gone below the water table.

2.43 It was informed to OGE that pumping is necessary only during wet periods and for a limited period of time. Discharge to surface water is therefore seasonal and intermittent. This indicates that water collected in the excavation is mainly surface water runoff from surrounding areas and direct rainfall onto excavation.

2.44 There is an existing discharge licence for discharging water from the North Quarry (L WAT 41). The maximum discharge allowed is 30m³/hr (720m³/d). Every two months samples are collected and tested from the upstream and downstream of the discharge point. A flow meter has been installed to measure the amount of water being discharged off site and measurements are recorded.

1, 50 and 100 year 24 Hour storm events

2.45 The Flood Studies Report has been used to calculate the yearly storm event applicable to the quarry area: annually; 1 in 50 year; and 1 in 100 year storm events of 24 hours duration, the results of which are shown in *Table No. 2.3, Table No. 2.4*. Calculations are shown in *Appendix No. 1.* Calculations are done separately for the current excavation area in the north quarry and the proposed excavation area in the north quarry.

Table No. 2.3: **Yearly, 1 in 50 and 1 in 100 year storm events for current excavation area in the north quarry**

	1 year	1 in 50 year	1 in 100 year
m^3/hr	93	188	213
m^3/day	2,232	4,512	5,112

Table No. 2.4: **Yearly, 1 in 50 and 1 in 100 year storm events for proposed excavation area in the north quarry**

	1 year	1 in 50 year	1 in 100 year
m^3/hr	30	61	69
m^3/day	720	1464	1656

2.46 The 50 and 100 year storm event for the current north quarry were calculated to be $188m^3/hr$ and $213m^3/hr$ respectively. The maximum discharge permitted from the North quarry as per the licence (L WAT 41) is $30m^3/hr$ ($720m^3/d$). The pump is capable of operating at a rate of 8.3l/s ($30m^3/hr$). In the event of any rainstorm, excess of this is stored in the quarry floor. In effect the quarry and pump system act as an attenuation system in storm conditions.

2.47 OGE was informed by the quarry management that continuous pumping is needed only on very wet days. This was confirmed by the flow meter records. During the days of site visit, even though they were very wet days (31st January and 1st February, 2008), the pump was in operation for a few hours. Hence it is assumed that the present discharge limit of $30m^3/hr$ ($720m^3/d$) from the north quarry is sufficient to the existing situation.

2.48 Excavation of the proposed extension will significantly increase the catchment area of the north quarry. During a 100 year storm event there is a potential for an additional $69m^3/hr$ of precipitation to enter the north quarry. Potential ground water inflows have not been investigated. OGE would advice revising the discharge licence in the event of excess ingress of water into the quarry during possible future excavation.

HYDROCHEMISTRY

2.49 The quarry has two discharge licences for discharging the water from the North quarry and the main quarry. Samples are collected and tested every month at the discharge point from the main quarry. Also samples from the upstream and downstream of the discharge point from the Northern quarry are tested every two months. Results for the latest analysis obtained are shown below in *Table No. 2.5* and the certificates of analyses are shown in *Appendix No. 2*. A map showing the discharge points and the sample points is also enclosed in *Appendix No. 2*.

Table No. 2.5: Chemistry Results

Sample collected on 25/10/07	Main Quarry Discharge Point	Upstream of Discharge point - North Quarry	Downstream of Discharge point - North Quarry
Suspended solids (mg/l)	<2	<2	<2
pH	7.1	7.9	8.2
Total Phosphorous as P (mg/l)	0.012	0.013	0.018
Orthophosphate as P	<0.01	<0.01	<0.01
Ammonia as N (mg/l)	0.023	0.026	0.02
Total Aluminimum (µg/l)	<20	<20	<20

2.50 The chemistry results from the upstream and downstream point to the proposed discharge point are similar. This shows that the discharge from the quarry does not impact on the quality of water in the stream.

2.51 Three samples from the Durnesh Lake are also analysed every two months (*refer to Appendix No. 2 for sample locations*). Results for the latest analysis are shown below in *Table No. 2.6*.

Table No. 2.6: Chemistry Results from Durnesh Lake

Sample collected on 25/10/07	Sampling Point 1	Sampling Point 2	Sampling Point 3
Suspended solids (mg/l)	4	<2	5
pH	8.3	7.7	7.8
Total Phosphorous as P (mg/l)	0.028	0.065	0.041
Orthophosphate as P	<0.01	0.017	<0.01
Ammonia as N (mg/l)	0.068	0.03	0.341
Total Aluminimum (µg/l)	<20	<20	28

2.52 The results from the Dunesh Lake show slightly higher values for the parameters compared with the sample results in *Table No. 4.6*. However, all these values are below the quality standards set out for the discharge from the quarry (*Table No. 2.7*). Also it is to be considered that the proposed quarry is approximately 2.5km away from the lake and there could be other contributors within the catchment area of the Durnesh Lake.

Table No. 2.7: Quality Standards as per Discharge Licences

Parameter	Main Quarry (L WAT 48)	North Quarry (L WAT 41)
Suspended solids (mg/l)	20	20
pH	6 - 9	6 - 9
Total Phosphates as P (mg/l)	0.5	0.5
Ammonia as N (mg/l)	5	5
Aluminimum (mg/l)	0.2	0.2

2.53 Samples of water were taken by OGE during the site visit from:

1. North Quarry Sump (Sample ID : Sump)
2. At the discharge point from the northern quarry (Sample ID : ND)
3. At the discharge point from the settlement lagoon from the main quarry (Sample ID : DS)

2.54 This sampling was carried out on the 31st of January 2008. The samples were sent to Nutrisolv Ireland Ltd., Sligo for analysis. The objective of the sampling was to establish the existing hydrochemistry of ground water being removed from the site, and the quality of the water discharged off site. Certificates of Analysis are provided in *Appendix 3*.

Interpretation

2.55 The water quality of the water samples taken from the three sampling points listed were compared with the Directive controlling the management of surface water intended for human consumption (75/440/EC). The results are presented in *Table No. 2.8*.

2.56 Most of the parameters tested are within the guideline values. Compared to the sample collected from the quarry sump, it is evident that the water discharged off site has a better quality. This is expected as the quarry sump, attenuation area and the settlement ponds treat the water before being discharged off site. All the parameters are within the limit set out in the existing discharge licences for the quarry.

2.57 The hydrochemical results showed nitrate levels to be within the limits for surface water intended for human consumption (75/440/EC). However for Ammonia, the value is higher than the value obtained for the samples analyzed in October 2007 as shown in *Table No. 2.5*. The value is higher than the guideline value intended for A1 waters. This could be from the water infiltrating into the excavation area from the surrounding fields (the surrounding fields are used as grazing lands). As there are no data for the quality of water outside the quarry, this could not be confirmed.

Table No. 2.8 – **Hydrochemistry of Water Samples**

Parameter	Units	North Quarry (NQ) Sump	At the Discharge Point from NQ	At the Discharge Point From the main quarry	Standard for surface water intended for drinking 75/440/EEC
Conductivity	µS/cm	483	394	459	1000
Temperature	°C	7.55	5.83	7.58	
DO	%	64.6	77.6	61.8	>70
pH		7.71	7.48	7.15	6.5-8.5
APHA - Turbidity	NTU	100	90	1.5	-
Diesel Range Organics	mg/l	2.8	0.012	0.027	-

Mineral oil	mg/l	1.5	0.01	0.02	-
BOD	mg/l	3	2	<2	5
Total suspended solids @103°C	mg/l	133	<2	<2	25
Total settleable solids	mg/l	<2	<2	<2	-
Ammonia (NH_3-N)	mg/l	1.07	0.432	0.053	0.05
Nitrate (NO_3-N)	mg/l	3.7	3.5	1.5	
Nitrate (NO_3)	mg/l	16.39	15.5	6.64	25
Ortho-phosphate	mg/l	0.046	0.017	<0.002	
Total phosphorous (P)	mg/l	0.055	0.018	<0.002	0.03
Sulphate (SO_42-)	mg/l	26.58	24.37	21.31	150
Chloride (Cl-)	mg/l	38.5	35.9	37.5	200
Calcium	mg/l	160	110	88	200
Magnesium	mg/l	21	19	4.9	50
Potassium	mg/l	2.3	2.1	3.4	12
Sodium	mg/l	19	17	16	150
Arsenic	mg/l	0.0052	0.0023	0.00023	0.01
Chromium	mg/l	0.0095	0.0079	0.0071	0.05
Copper	mg/l	0.031	0.0021	<0.002	0.02
Lead	mg/l	0.018	0.048	<0.002	0.05
Nickel	mg/l	0.028	0.016	<0.00052	-
Zinc	mg/l	0.013	<0.006	<0.006	0.5

HYDROGEOLOGICAL CONCEPTUAL MODEL

2.58 The following is a basic hydrogeological conceptual model outlining the major quarry inflows and outflows.

- Recharge - Quarry application area effective annual rainfall = 766mm
  - Total surface water catchment to the entire site = 400,000m²
  - Annual ground water recharge to the quarry (based on surface catchment) = 400,000 x 0.766 x 85% = 260,440 m³/yr

Main Quarry

- Annual ground water recharge

= 230,000 x 0.766 x 85% = 149,753m³/y

North Quarry – Current Excavation Area

- Annual groundwater recharge

= 76,000 x 0.766 x 85% = 49,484m³/y

North Quarry – Proposed Excavation Area

- Annual ground water recharge

= 84,000 x 0.766 x 85% = 54,692m³/y

- Usage
  - Concrete production = 3,640 m³/yr
  - Wheel wash /dust suppression = 500 m³/yr
  - Chips washing = 200 m³/yr (90% recycled) = 20 m³/yr
- Boundaries
  - Catchment divide: General head boundary
  - Hydraulic boundary: topographic boundary
  - No groundwater flow boundary
- Outflow
  - Maximum discharge from North Quarry = 700m³/day
  - Discharge passed through two attenuation areas
  - Maximum discharge from main quarry = 700m³/day
  - Discharge passed through two-stage settlement lagoon and oil interceptor

2.59 There is no net removal of water from the study catchment.

IMPACTS

2.60 The lowest point in the North quarry is at present 40m OD. Ground water levels within the quarry site have not been established. OGE recommends drilling wells within the quarry boundary to facilitate ground water level measurements.

2.61 The hydrochemical results showed Ammonia is higher in concentration than the value obtained for the samples analysed in October 2007 as shown in *Table No. 2.8*. However the result of 1.07mg/l is still under the maximum standard of 5mg/l required by the current discharge licence. This increase in concentration could be from the water infiltrating into the excavation area from the surrounding fields which are under agricultural grassland.

RESIDUAL IMPACTS

2.62 The residual impacts caused by the proposed quarry extension include the stripping of soils which when replaced will have become altered in structure. Drainage patterns will also be altered due to the negative head pressure imposed by the lowest bench in the quarry. The surface and ground water flow pathways and flow volumes will also be affected.

MITIGATION

2.63 The mitigation measures presented have been specifically designed to address the potential impacts outlined in the previous section.

Hydrochemical Parameters for Annual Monitoring

2.64 The parameters listed in the *Table No. 2.9* below are considered important for annual monitoring of the ground water. These should be included in any analysis of the ground water that is pumped out of the quarry excavation.

Table No. 2.9: **Parameters to be analysed on an annual basis.**

Parameter	Units	Parameter	Units
Alkalinity	mg/l as $CaCO_3$	Total Organic Carbon	mg/l
Calcium	mg/l Ca	COD on unfiltered sample	ppm
Magnesium	mg/l Mg	Total Suspended Solids	ppm
Sodium	mg/l Na	Chloride	mg/l Cl
Potassium	mg/l K	Ammonia	mg/l as N
Iron	mg/l Fe	Nitrate	mg/l as NO_3
Manganese	mg/l Mn	Nitrite	mg/l as NO_2
Orthophosphate	mg/l as P	Sulphate	mg/l as SO_4
Total Dissolved Solids	mg/l @ 180°C		

Quarry Water Management

2.65 Water from the sump in the North Quarry is pumped out after being attenuated at two levels. To mitigate against runoff high in suspended solids and possible hydrocarbon spillage OGE would recommend installing a silt trap and an oil interceptor (*Appendix 4*) and allowing the water to pass through them before being discharged off site.

CONCLUSIONS

2.66 If there are no alterations to quarry management there will not be a large impact on the overall ground water resources in the area from the proposed quarry area.

2.67 Flora and fauna will not be affected by the proposed discharge.

2.68 There is no net abstraction of ground water from the study catchment.

2.69 Quarry operations and quarry management do not have any negative impact on ground water resources.

2.70 Quarry operations and quarry management do not have any negative impact on local surface water resources.

Recommendations

2.71 OGE was informed and provided with details of existing discharge licences for the main quarry and the north quarry. In the event of any storm event, excess water generated will be stored in the quarry floors and will be discharged off site as per the existing licences.

4.72 OGE has observed water ingress into the quarry from the fissured rocks being extracted. Features like bedding and fracturing were observed on the quarry faces. The present finished floor level is approximately 40m OD in the North Quarry. However, the ground water level has not been established within the proposed quarry site as there are no boreholes on the site.

2.73 Hence OGE would recommend drilling a minimum of three boreholes within the proposed quarry extension area to establish the groundwater level. The water samples from these wells should be tested to establish the quality of ground water at the site.

2.74 It is recommend a pump test to be carried out to establish the cone of drawdown to prove that quarry excavation would not impact existing wells in use, if any, around the quarry site.

REFERENCES

Details of the references reviewed and/or quoted are presented below:

CUNNANE & LYNN. 1975. *Flood estimation following the Flood studies Report.*

ENVIRONMENTAL PROTECTION AGENCY. 1999. *Waste Water Treatment Manuals: Treatment systems for small communities, business, leisure centres and hotels.* Environmental Protection Agency, Johnstown Castle, Wexford.

ENVIRONMENTAL PROTECTION AGENCY. 2000. *Towards Setting Guideline Values For The Protection Of Groundwater In Ireland.* Environmental Protection Agency, Johnstown Castle, Wexford.

ENVIRONMENTAL PROTECTION AGENCY. 2006. *Environmental Management Guidelines: Environmental Management in the Extractive Industry (non-scheduled minerals).* Environmental Protection Agency, Johnstown Castle, Wexford.

EUROPEAN COMMUNITIES. 1988. *Regulations: Quality for Water Intended for Human Consumption, 1988.*

FRREZE, R.A. AND CHERRY, J.A. 1979. *Groundwater.* Prentice Hall, Eaglewood Cliffs, New Jersey.

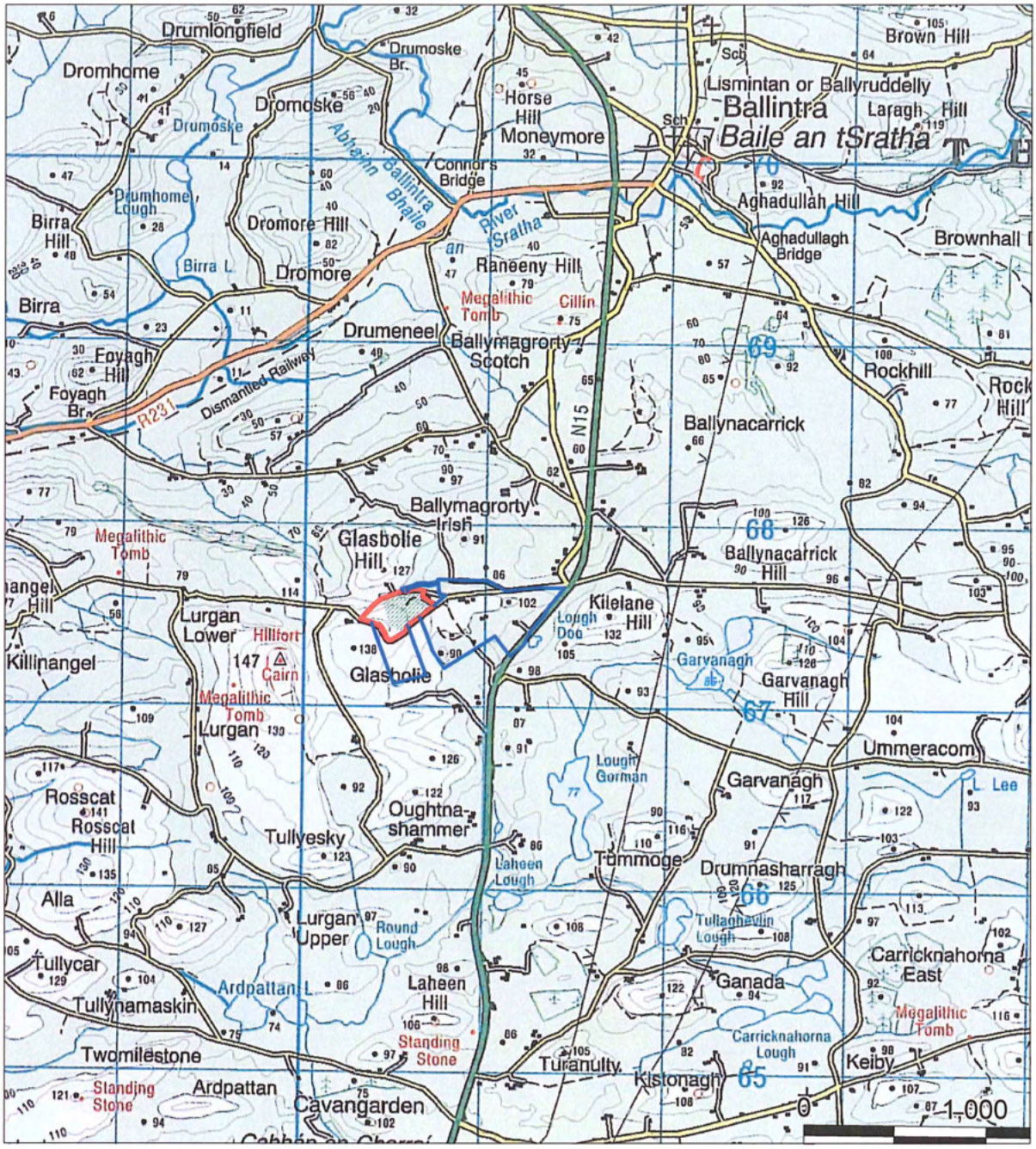
GEOLOGICAL SURVEY OF IRELAND. 2004. *Groundwater Working Group – Guidance on the assessment of the impact of groundwater abstractions: GW5.* Geological Survey of Ireland, Haddington Road, Dublin 4.

GEOLOGICAL SURVEY OF IRELAND, *Geology of South Donegal, Sheet 3*

GRAY, N.F. 1999. *Water Technology: An Introduction for Environmental Scientists and Engineers.* Butterworth-Heineman, Oxford.

INSTITUTE OF HYDROLOGY. 1993. Flood Studies Report (In Five Volumes), 3rd binding. Institute of Hydrology, Wallingford.

MARTIN & CUNNANE. 1976. *Analysis and Prediction of Low Flow and Drought Volumes for Selected Irish Rivers.*



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

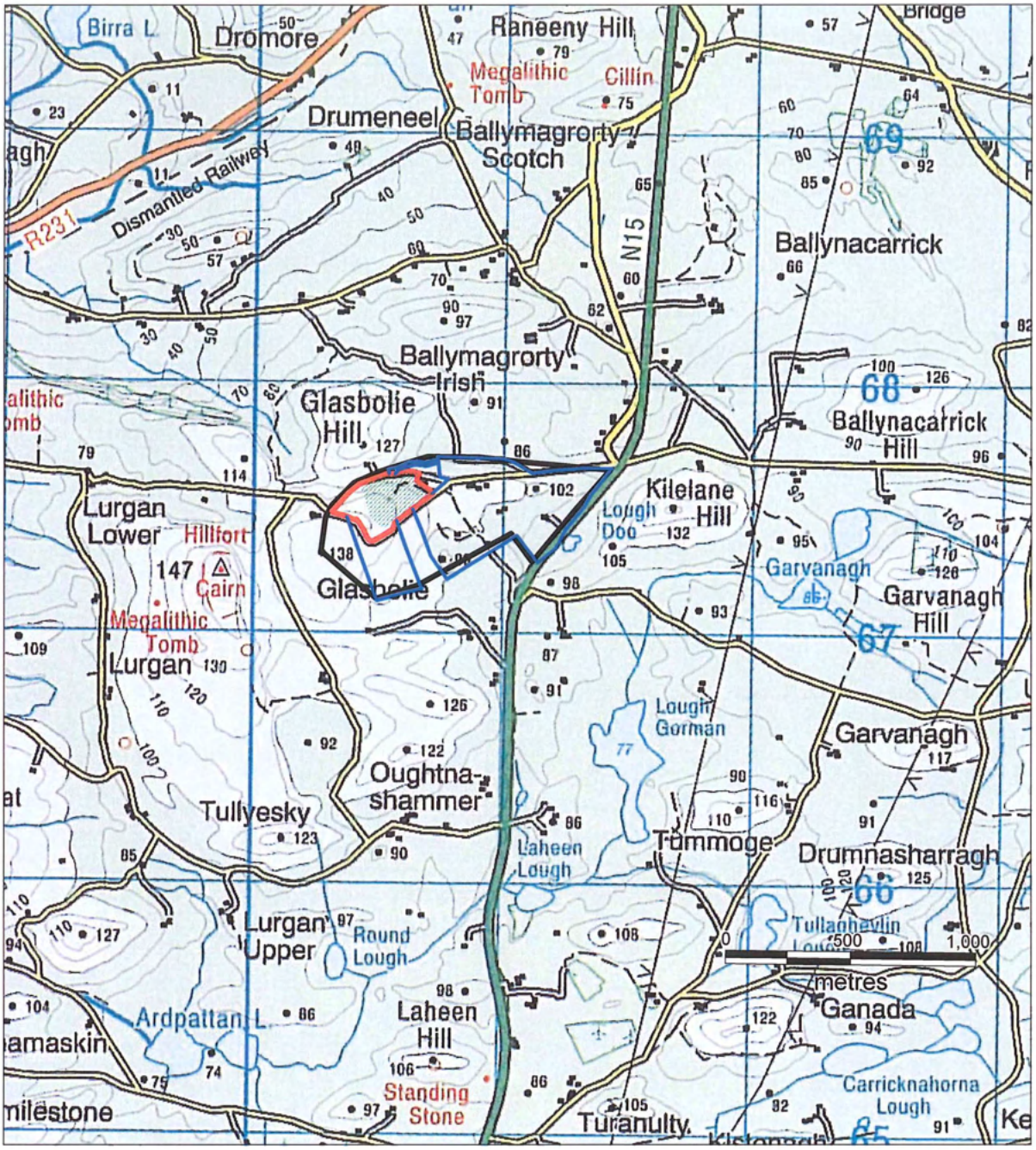
Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Site Location

Key: Landholding Outline; Site Outline; Retention Area

Scale: 1:50,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.1
Drawn by BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

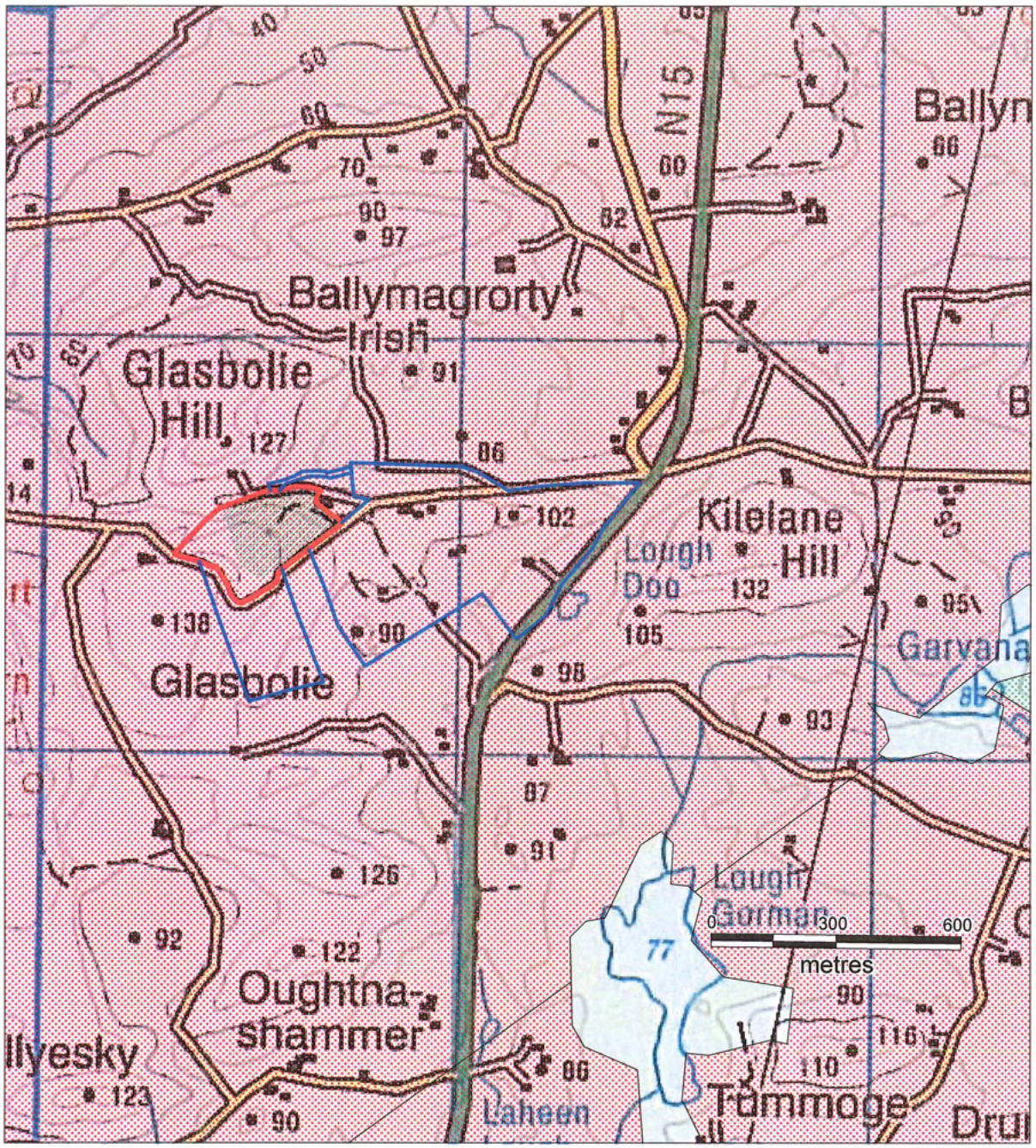
Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Site Location & Catchment Boundary

Key: Landholding Outline; Site Outline; Catchment Boundary

Scale: 1:25,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.2
Drawn by: BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

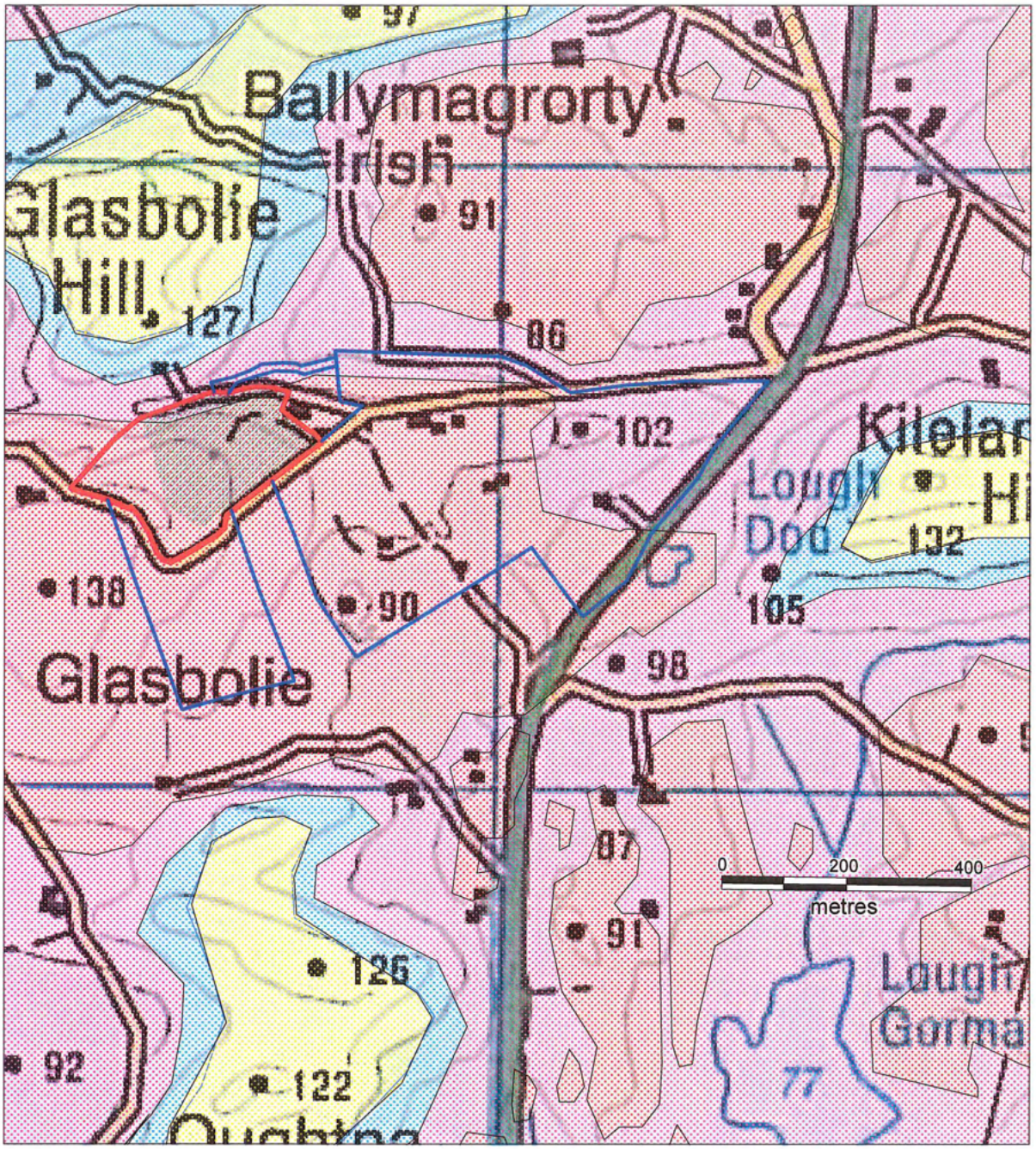
Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Aquifer Map

Key:
- Karstified Aquifer
- Poorly Productive Bedrock Aquifer
- Productive Fissured Bedrock Aquifer

Scale: 1:15,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.3
Drawn by BS	**Reference:** 0170801



Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Aquifer Vulnerability Map

Key:
- E - Extreme (Rock near Surface or Karst)
- E- Extreme
- H - High
- M - Moderate

Scale: 1:10,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.4
Drawn by BS	**Reference:** 0170801

Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

Title: Source Protection Zone

Key: Landholding Outline; Retention Area; Site Outline; Source Protection Zone

Scale: 1:50,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.5
Drawn by BS	**Reference:** 0170801

Map No. 11 1:50000 Discovery Series
Ordnance Survey Ireland Licence No. EN 0006108
Ordnance Survey of Ireland and
Government of Ireland

O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

Client: Earthscience Partnership

Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal

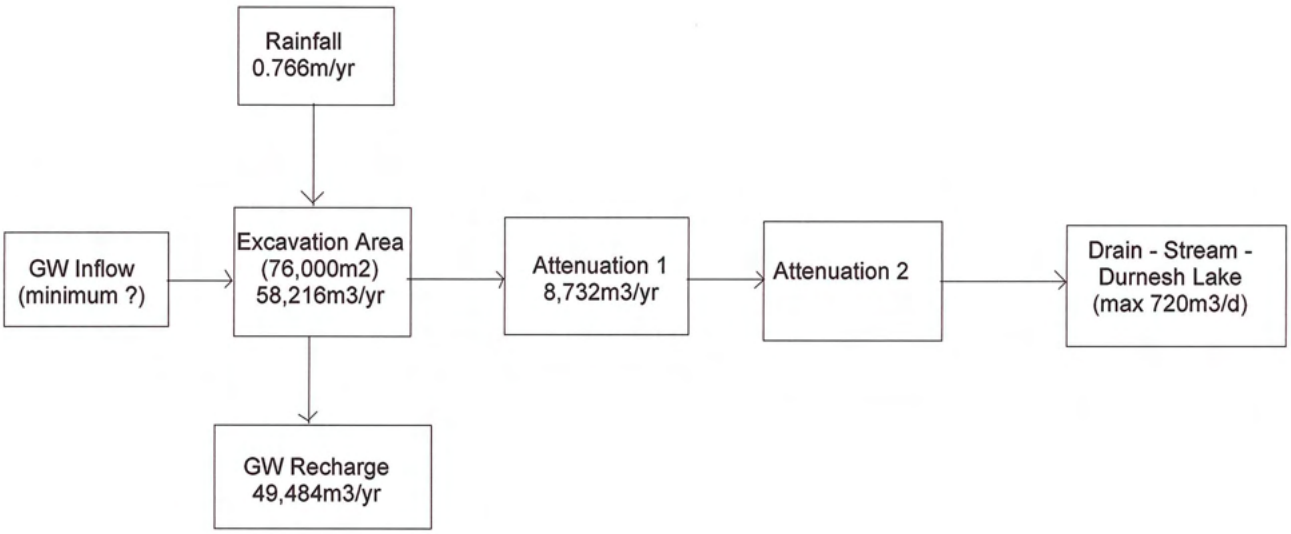
Title: Wells mapped from GSI database

Key: Landholding Outline; Retention Area; Site Outline; GSI mapped wells

Scale: 1:50,000	**Datum:** Malin
Date: June 2008	**Checked:** AVZ
Author: BS	**Figure no:** 2.6
Drawn by BS	**Reference:** 0170801

N

Water Management - North Quarry - Current Excavation Area



O'Neill
ground water engineering

Unit D5, M7 Business Park,
Newhall, Naas,
Co. Kildare, Ireland
Ph:+353 45 895668
Fax:+353 45 881705
Mob:+353 87 2300933
info@groundwatereng.ie

Client: Earthscience Partnership	**Key:**	
Project: Water Section For a Proposed Quarry Extension at P Mc Caffrey & Sons Ltd, Ballymagrorty, Ballintra, Co. Donegal	**Scale:** N/A	**Datum:** N/A
	Date: June 2008	**Checked:** AVZ
Title: Quarry Water Management - North Quarry	**Author:** BS	**Figure no:** 2.7
	Drawn by: BS	**Reference:** 0170801

ORDNANCE SURVEY OF IRELAND, *Discovery Series, 1:50,000, Maps 11; Donegal.*

APPENDIX 1
CALCULATIONS OF YEARLY, 1 IN 50 AND 1 IN 100 YEARS RETURN PERIOD 24 HOUR STORM EVENTS

Caculation of 50 Year and 100 Year 24 Hour Return Period Design Rainfall

For the North Quarry Current Excavation Area

Annual 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	r (1 hr -M.) / (2-day M.)	Storm Duration	r_D (DR.) / (2-day M.)	Dr_5	Growth Factor (M_T/M_5)	Dr_1	DR_1	Area	Flow	Flow
(mm)	(%)	(hours)		mm		mm	m	m^2	m^3/durati	m^3/hr
				(i)×(iv)		(v)×(vi)				
60	0.3	0.5	0.23	13.80	0.69	9.52	0.010	58300	555	1110
60	0.3	1	0.30	18.00	0.70	12.60	0.013	58300	735	735
60	0.3	2	0.38	22.80	0.71	16.19	0.016	58300	944	472
60	0.3	6	0.54	32.40	0.72	23.33	0.023	58300	1360	227
60	0.3	12	0.68	40.80	0.74	30.19	0.030	58300	1760	147
60	0.3	24	0.85	51.00	0.75	38.25	0.038	58300	2230	93

50 Year 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	r (1 hr -M.) / (2-day M.)	Storm Duration	r_D (DR.) / (2-day M.)	Dr_5	Growth Factor (M_T/M_5)	Dr_{50}	DR_{50}	Area	Flow	Flow
(mm)	(%)	(hours)		mm		mm	m	m^2	m^3/durati	m^3/hr
						(v)×(vi)				
60	0.3	0.5	0.23	13.80	1.70	23.46	0.023	58300	1368	2735
60	0.3	1	0.30	18.00	1.68	30.24	0.030	58300	1763	1763
60	0.3	2	0.38	22.80	1.65	37.62	0.038	58300	2193	1097
60	0.3	6	0.54	32.40	1.60	51.84	0.052	58300	3022	504
60	0.3	12	0.68	40.80	1.56	63.65	0.064	58300	3711	309
60	0.3	24	0.85	51.00	1.52	77.52	0.078	58300	4519	188

100 Year 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	r (1 hr -M.) / (2-day M.)	Storm Duration	r_D (DR.) / (2-day M.)	Dr_5	Growth Factor (M_T/M_5)	Dr_{100}	DR_{100}	Area	Flow	Flow
(mm)		hours		mm		mm	m	m^2	m^3/durati on	m^3/hr
				(i)×(iv)		(v)×(vi)				
60	0.3	0.5	0.23	13.80	1.98	27.32	0.027	58300	1593	3186
60	0.3	1	0.30	18.00	1.95	35.10	0.035	58300	2046	2046
60	0.3	2	0.38	22.80	1.91	43.55	0.044	58300	2539	1269
60	0.3	6	0.54	32.40	1.83	59.29	0.059	58300	3457	576
60	0.3	12	0.68	40.80	1.77	72.22	0.072	58300	4210	351
60	0.3	24	0.85	51.00	1.72	87.72	0.088	58300	5114	213

Where:

2-day M_5 is two day rainfall with a return period of 5 years (mm)

r is ratio of one hour duration five year return period over two day rainfall five year return period

DR_5 is five year return period rainfall for the duration of interest

DR_x is the x year return period rainfall for the duration of interest

Caculation of 50 Year and 100 Year 24 Hour Return Period Design Rainfall

For the Proposed Extension to the North Quarry

Annual 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	**r** (1 hr -M.) / (2-day M.)	**Storm Duration**	**r_D** (DR.) / (2-day M.)	**Dr_5**	**Growth Factor** (M_T/M_5)	**Dr_1**	**DR_1**	**Area**	**Flow**	**Flow**
(mm)	(%)	(hours)		mm		mm	m	m^2	m^3/duration	m^3/hr
				(i)×(iv)		(v)×(vi)				
60	0.3	0.5	0.23	13.80	0.69	9.52	0.010	18900	180	360
60	0.3	1	0.30	18.00	0.70	12.60	0.013	18900	238	238
60	0.3	2	0.38	22.80	0.71	16.19	0.016	18900	306	153
60	0.3	6	0.54	32.40	0.72	23.33	0.023	18900	441	73
60	0.3	12	0.68	40.80	0.74	30.19	0.030	18900	571	48
60	0.3	24	0.85	51.00	0.75	38.25	0.038	18900	723	30

50 Year 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	**r** (1 hr -M.) / (2-day M.)	**Storm Duration**	**r_D** (DR.) / (2-day M.)	**Dr_5**	**Growth Factor** (M_T/M_5)	**Dr_{50}**	**DR_{50}**	**Area**	**Flow**	**Flow**
(mm)	(%)	(hours)		mm		mm	m	m^2	m^3/duration	m^3/hr
						(v)×(vi)				
60	0.3	0.5	0.23	13.80	1.70	23.46	0.023	18900	443	887
60	0.3	1	0.30	18.00	1.68	30.24	0.030	18900	572	572
60	0.3	2	0.38	22.80	1.65	37.62	0.038	18900	711	356
60	0.3	6	0.54	32.40	1.60	51.84	0.052	18900	980	163
60	0.3	12	0.68	40.80	1.56	63.65	0.064	18900	1203	100
60	0.3	24	0.85	51.00	1.52	77.52	0.078	18900	1465	61

100 Year 24 Hour Return Storm Event

i	ii	iii	iv	v	vi					
2-day M_5	**r** (1 hr -M.) / (2-day M.)	**Storm Duration**	**r_D** (DR.) / (2-day M.)	**Dr_5**	**Growth Factor** (M_T/M_5)	**Dr_{100}**	**DR_{100}**	**Area**	**Flow**	**Flow**
(mm)		hours		mm		mm	m	m^2	m^3/duration	m^3/hr
				(i)×(iv)		(v)×(vi)				
60	0.3	0.5	0.23	13.80	1.98	27.32	0.027	18900	516	1033
60	0.3	1	0.30	18.00	1.95	35.10	0.035	18900	663	663
60	0.3	2	0.38	22.80	1.91	43.55	0.044	18900	823	412
60	0.3	6	0.54	32.40	1.83	59.29	0.059	18900	1121	187
60	0.3	12	0.68	40.80	1.77	72.22	0.072	18900	1365	114
60	0.3	24	0.85	51.00	1.72	87.72	0.088	18900	1658	69

Where:

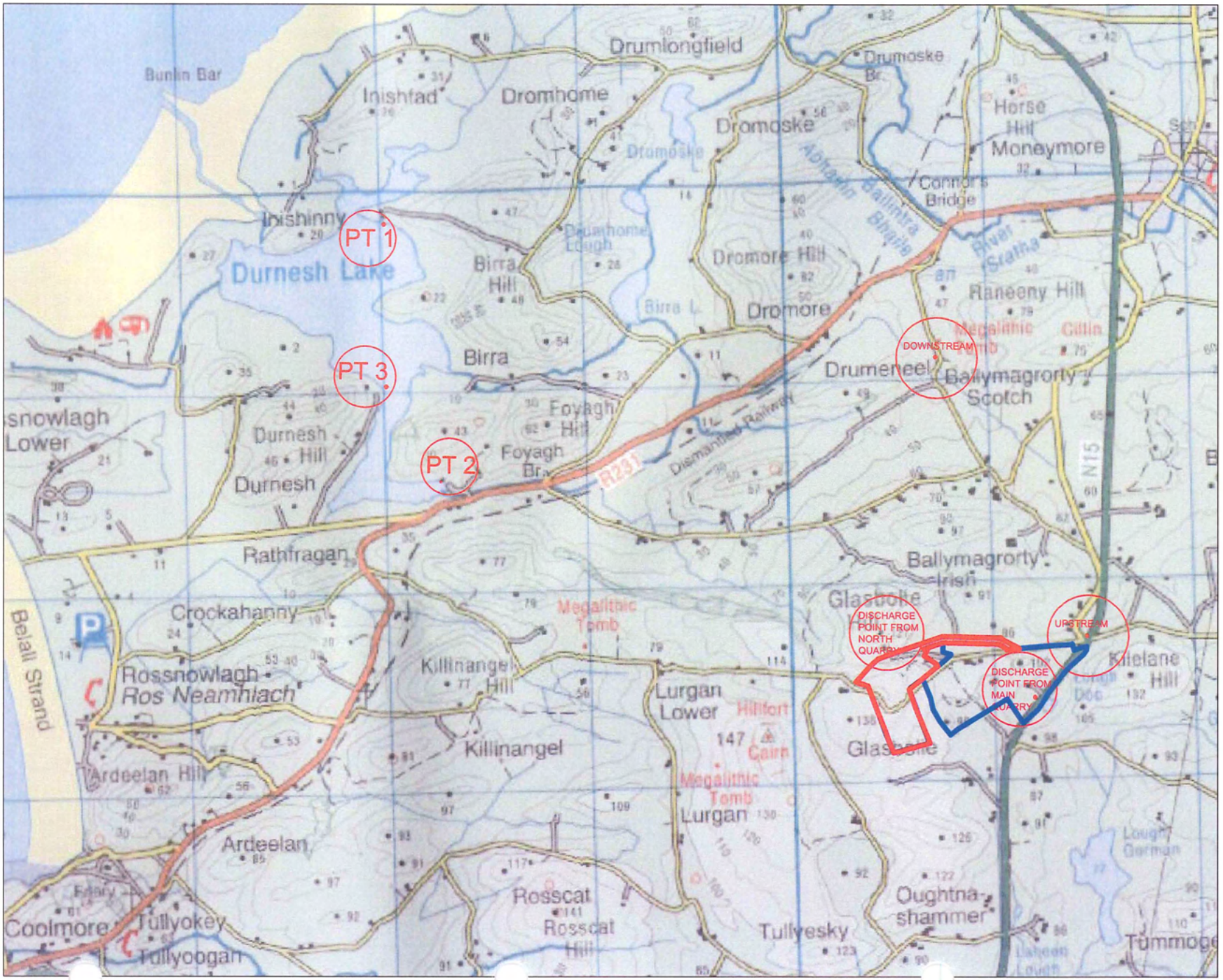
2-day M_5 is two day rainfall with a return period of 5 years (mm)

r is ratio of one hour duration five year return period over two day rainfall five year return period

DR_5 is five year return period rainfall for the duration of interest

DR_x is the x year return period rainfall for the duration of interest

APPENDIX 2
CERTIFICATES OF ANALYSIS FOR THE SAMPLES FROM THE SOUTH QUARRY, UPSTREAM AND DOWNSTREAM TO THE DISCHARGE POINT AND DURNESH LAKE



LEGEND

Site Outline.

Total Site Area: 12.33 ha.

O.S. Ref. No: Discovery Map 16

N

Description	Date

EARTH SCIENCE PARTNERSHIP

CONSULTING ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

James Street Westport Co. Mayo
tel:- +353(098) 28999 fax- +353(098) 24727
e-mail: earthsciencepartnership@gmail.com

Ordnance Survey Ireland Copyright Licence No.: EN 0071101

Client:- Patrick McCaffery & Sons Ltd.

Project:-
Planning Permission for Retention And Extension to Quarry at Glasbolie, Ballymagrorty Irish, Ballintra, Co. Donegal.

Title:- Water Sampling Location Map

Drawn By: T. Sheridan

Checked By:

Scale: 1:25,000	Date: Jan. 2008
Job No: EI 027	Rev:

Drawing No: QPF 0

COMPLETE LABORATORY SOLUTIONS

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client	:	Eileen Mullarkey Earth Science Partnership Ltd. James Street Westport Co. Mayo	Report No. Date of Receipt Start Date of Analysis Date of Report Order Number Sample taken by	: : 26/10/2007 : 26/10/2007 : 31/10/2007 : : CLS	62241

CERTIFICATE OF ANALYSIS

148640	EI027, Mc Caffrey's Downstream, 25/10/07	Suspended Solids (sw)	<2	mg/l
		pH	8.2	pH Units
		Total Phosphorus as P (sw)	0.018	mg/l
		Orthophosphate as P	<0.01	mg/l
		Ammonia as N	0.02	mg/l
		Aluminium, total	<20	ug/l

IRISH NATIONAL ACCREDITATION BOARD
TESTING
DETAILED IN SCOPE REG NOS. 108T AND 109T

Authorised by:
Caecilia Terloh
Deputy Quality Manager

See reverse for Test Specifications
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client : Eileen Mullarkey
Earth Science Partnership Ltd.
James Street
Westport
Co. Mayo

Report No.	: 62239
Date of Receipt	: 26/10/2007
Start Date of Analysis	: 26/10/2007
Date of Report	: 31/10/2007
Order Number	:
Sample taken by	: CLS

CERTIFICATE OF ANALYSIS

148638	EI027, Mc Caffrey's, Durnesh Lake, Sampling point 3, 25/10/07	Suspended Solids (sw)	5	mg/l
		pH	7.8	pH Units
		Total Phosphorus as P (sw)	0.041	mg/l
		Orthophosphate as P	<0.01	mg/l
		Ammonia as N	0.341	mg/l
		Aluminium, total	28	ug/l

DETAILED IN SCOPE REG NOS. 108T AND 109T

Authorised by: Caecilia Teoh
Caecilia Teoh
Deputy Quality Manager

See reverse for Test Specifications
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

COMPLETE LABORATORY SOLUTIONS

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client	:	Eileen Mullarkey	Report No.	:	62240
		Earth Science Partnership Ltd.	Date of Receipt	:	26/10/2007
		James Street	Start Date of Analysis	:	26/10/2007
		Westport	Date of Report	:	31/10/2007
		Co. Mayo	Order Number	:	
			Sample taken by	:	CLS

CERTIFICATE OF ANALYSIS

148639	E1027, Mc Caffrey's Upstream, 25/10/07	Suspended Solids (sw)	<2	
		pH	7.9	pH Units
		Total Phosphorus as P (sw)	0.013	mg/l
		Orthophosphate as P	<0.01	mg/l
		Ammonia as N	0.026	mg/l
		Aluminium, total	<20	ug/l

IVNAB
DETAILED IN SCOPE REG NOS. 109T AND 109T

Authorised by: Caecilia Terloh

Caecilia Terloh
Deputy Quality Manager

See reverse for Test Specifications
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client :	Eileen Mullarkey	Report No.	: 62236
	Earth Science Partnership Ltd.	Date of Receipt	: 26/10/2007
	James Street	Start Date of Analysis	: 26/10/2007
	Westport	Date of Report	: 31/10/2007
	Co. Mayo	Order Number	:
		Sample taken by	: CLS

CERTIFICATE OF ANALYSIS

148635	EI027 McCaffrey's Discharge, 25/10/07	Suspended Solids (sw)	<2	mg/l
		pH	7.1	pH Units
		Total Phosphorus as P (sw)	0.012	mg/l
		Orthophosphate as P	<0.01	mg/l
		Ammonia as N	0.023	mg/l
		Aluminium, total	<20	ug/l

DETAILED IN SCOPE REG NOS. 1087 AND 1091

Authorised by: Caecilia Terloh
Caecilia Terloh
Deputy Quality Manager

See reverse for Test Specifications
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

COMPLETE LABORATORY SOLUTIONS

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client	:	Eileen Mullarkey	Report No.	:	62238
		Earth Science Partnership Ltd.	Date of Receipt	:	26/10/2007
		James Street	Start Date of Analysis	:	26/10/2007
		Westport	Date of Report	:	06/11/2007
		Co. Mayo	Order Number	:	
			Sample taken by	:	CLS

CERTIFICATE OF ANALYSIS

Sample No.	Sample Description	Test	Result	Units
148637	EI027, Mc Caffrey's, Dumesh Lake, Sampling point 2, 25/10/07	Suspended Solids (sw)	<2	mg/l
		pH	7.7	pH Units
		Total Phosphorus as P (sw)	0.065	mg/l
		Orthophosphate as P	0.017	mg/l
		Ammonia as N	0.03	mg/l
		Aluminium, total	<20	ug/l

IRNAB
DETAILED IN SCOPE REG NOS. 109T AND 109T

Authorised by: Caecilia Terloh

Caecilia Terloh
Deputy Quality Manager

See reverse for Test Specifications

This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

Complete Laboratory Solutions
Ros Muc, Co. Galway.
[Tel] 091 574355
[Fax] 091 574356
[Email] info@cls.ie
[web] www.completelabsolutions.com

Client :	Eileen Mullarkey	Report No.	: 62237
	Earth Science Partnership Ltd.	Date of Receipt	: 26/10/2007
	James Street	Start Date of Analysis	: 26/10/2007
	Westport	Date of Report	: 31/10/2007
	Co. Mayo	Order Number	:
		Sample taken by	: CLS

CERTIFICATE OF ANALYSIS

148536	EI027, Mc Caffrey's, Durnesh Lake, Sampling point 1, 25/10/07	Suspended Solids (sw)	4	mg/l
		pH	8.3	pH Units
		Total Phosphorus as P (sw)	0.026	mg/l
		Orthophosphate as P	<0.01	mg/l
		Ammonia as N	0.068	mg/l
		Aluminium, total	<20	ug/l

DETAILED IN SCOPE REG NOS. 108T AND 106T

Authorised by: Caecilia Terloh
Caecilia Terloh
Deputy Quality Manager

See reverse for Test Specifications
This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

APPENDIX 3
CERTIFICATE OF ANALYSIS FOR THE SAMPLES COLLECTED ON 31/01/2008

NUTRISOLV

Laboratory and Technical Services

Certificate of Analysis

13611

NUTRISOLV

Laboratory and Technical Services

Client	Analysis requested	Date of receipt	Report Date
O'Neill Ground Water		01/02/2008	18/02/2008
Address		**Sample Date**	**Sample ID**
Unit D5, M7 Buisness Park, Newhall, Naas Co. Kildare		31/01/2008	
FAO		**Client Reference**	
Shane O' Neill		Sump	
		Sample Description	
		Surface Water	

Parameter	Units	Method used
Biochemical Oxygen Demand (BOD_5)	3 mg/l	5210 B (BOD_5)
APHA - Turbidity	100 NTU	Hach Nephelometric Method APHA
Diesel Range Organics	2.8 mg/l	Analysis by GCFID
Mineral Oil	1.5 mg/l	By GCMS
Total Suspended Solids @103°C	133 mg/l	2540 D Total Suspended Solids
Settleable Solids	<2 mg/l	2540 F Settleable Solids (Imhoff)
Ammonia (NH_3-N)	1.07 mg/l	Ammonia 4500 ISE
Nitrate (NO_3-N)	3.7 mg/l	HACH Method 8039
Ortho-Phosphate	0.046 mg/l	standard Method 4500-P E
Total Phosphorus (P)	0.055 mg/l	4500-P B (5) Persulphate Digestion Method
Sulphate (SO_4^{2-})	26.58 mg/l	Method 8051 Hach
Cl^- (Chloride)	38.5 mg/l	Chloride Titritation 4500 Cl^- B
Potassium	2.3 mg/l	ICP Spectrometry
Sodium	19 mg/l	ICP - Spectrometry
Calcium	160 mg/l	ICP Spectrometry
Magnesium	21 mg/l	ICP Spectrometry

Authorisation

aul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

NUTRISOLV

Laboratory and Technical Services

Certificate of Analysis

13612

NUTRISOLV

Laboratory and Technical Services

Client	Analysis requested	Date of receipt	Report Date
O'Neill Ground Water		01/02/2008	18/02/2008
Address		**Sample Date**	**Sample ID**
Unit D5, M7 Buisness Park, Newhall, Naas Co. Kildare		31/01/2008	
FAO		**Client Reference**	
Shane O' Neill		DS	
		Sample Description	
		Surface Water	

Parameter	Units	Method used
Biochemical Oxygen Demand (BOD_5)	<2 mg/l	5210 B (BOD_5)
APHA - Turbidity	1.5 NTU	Hach Nephelometric Method APHA
Diesel Range Organics	0.027 mg/l	Analysis by GCFID
Mineral Oil	0.020 mg/l	By GCMS
Total Suspended Solids @103°C	<2 mg/l	2540 D Total Suspended Solids
Settleable Solids	<2 mg/l	2540 F Settleable Solids (Imhoff)
Ammonia (NH_3-N)	0.053 mg/l	Ammonia 4500 ISE
Nitrate (NO_3-N)	1.5 mg/l	HACH Method 8039
Ortho-Phosphate	<0.002 mg/l	standard Method 4500-P E
Total Phosphorus (P)	<0.002 mg/l	4500-P B (5) Persulphate Digestion Method
Sulphate (SO_4^{2-})	21.31 mg/l	Method 8051 Hach
Cl^- (Chloride)	37.5 mg/l	Chloride Titritation 4500 Cl^- B
Potassium	3.4 mg/l	ICP Spectrometry
Sodium	16 mg/l	ICP - Spectrometry
Calcium	88 mg/l	ICP Spectrometry
Magnesium	4.9 mg/l	ICP Spectrometry

Authorisation

ıul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

NUTRISOLV
Laboratory and Technical Services

Certificate of Analysis

13612

NUTRISOLV
Laboratory and Technical Services

Microbiological

Category 2

Arsenic	0.00023	mg/l	Hydride Vapour Generation
Chromium	0.0071	mg/l	ICP Spectrometry
Copper	<0.0020	mg/l	ICP Spectrometry
Lead	<0.0020	mg/l	ICP Spectrometry
Nickel	0.00052	mg/l	ICP Spectrometry
Zinc	<0.0060	mg/l	ICP Spectrometry

Authorisation

Paul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

NUTRISOLV

Laboratory and Technical Services

Certificate of Analysis

13613

NUTRISOLV

Laboratory and Technical Services

Client	Analysis requested	Date of receipt	Report Date
O'Neill Ground Water		01/02/2008	18/02/2008
Address		**Sample Date**	**Sample ID**
Unit D5, M7 Buisness Park, Newhall, Naas Co. Kildare		31/01/2008	
FAO		**Client Reference**	
Shane O' Neill		ND	
		Sample Description	
		Surface Water	

Parameter	Units	Method used
Biochemical Oxygen Demand (BOD_5)	2 mg/l	5210 B (BOD_5)
APHA - Turbidity	90 NTU	Hach Nephelometric Method APHA
Diesel Range Organics	0.012 mg/l	Analysis by GCFID
Mineral Oil	0.010 mg/l	By GCMS
Total Suspended Solids @103°C	<2 mg/l	2540 D Total Suspended Solids
Settleable Solids	<2 mg/l	2540 F Settleable Solids (Imhoff)
Ammonia (NH_3-N)	0.432 mg/l	Ammonia 4500 ISE
Nitrate (NO_3-N)	3.5 mg/l	HACH Method 8039
Ortho-Phosphate	0.017 mg/l	standard Method 4500-P E
Total Phosphorus (P)	0.018 mg/l	4500-P B (5) Persulphate Digestion Method
Sulphate (SO_4^{2-})	24.37 mg/l	Method 8051 Hach
Cl^- (Chloride)	35.9 mg/l	Chloride Titritation 4500 Cl^- B
Potassium	2.1 mg/l	ICP Spectrometry
Sodium	17 mg/l	ICP - Spectrometry
Calcium	110 mg/l	ICP Spectrometry
Magnesium	19 mg/l	ICP Spectrometry

Authorisation

Paul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

NUTRISOLV

Laboratory and Technical Services

Certificate of Analysis

13613

NUTRISOLV

Laboratory and Technical Services

Microbiological

Category 2

Arsenic	0.0023	mg/l	Hydride Vapour Generation
Chromium	0.0079	mg/l	ICP Spectrometry
Copper	0.0021	mg/l	ICP Spectrometry
Lead	0.048	mg/l	ICP Spectrometry
Nickel	0.016	mg/l	ICP Spectrometry
Zinc	<0.0060	mg/l	ICP Spectrometry

Authorisation

aul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

NUTRISOLV
Laboratory and Technical Services

Certificate of Analysis

13611

NUTRISOLV
Laboratory and Technical Services

Microbiological

Category 2

Arsenic	0.0052 mg/l	Hydride Vapour Generation
Chromium	0.0095 mg/l	ICP Spectrometry
Copper	0.031 mg/l	ICP Spectrometry
Lead	0.018 mg/l	ICP Spectrometry
Nickel	0.028 mg/l	ICP Spectrometry
Zinc	0.013 mg/l	ICP Spectrometry

Authorisation

Paul O'Dwyer

Analysis is carried out in accordance with the methods specified - Please see our standard terms and conditions.

APPENDIX 8-5

Water Discharge Licence Lwat 41 North - 2022

	JANUARY 2022		FEBRUARY 2022		MARCH 2022		APRIL 2022		MAY 2022		JUNE 2022		JULY 2022		AUGUST 2022		SEPTEMBER 2022		OCTOBER 2022		NOVEMBER 2022		DECEMBER 2022	
Date	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P
	CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES	
1	41478	671	62270	670	81046	671					118433	670					133917	678	143961	659	164257	659	182583	648
2	42149	671	62941	671	81717	671					119103	670					134595	678	144620	659	164915	658	183232	649
3	42820	671	63612	671	82388	671					119774	671					135273	678	145279	659	165573	658	183880	648
4	43492	672	64284	672	83055	669	85059	669			120444	670					135950	677	145937	658	166228	655	184527	647
5	44164	672	64956	672	83725	670	85728	669			121113	669					136061	111	146596	659	166884	656	185175	648
6	44835	671	65628	672	84390	665	86398	670	101028	670	121783	670							147255	659	167540	656	185823	648
7	45506	671	66299	671			87016	618	101698	670	121998	215							147913	658	168177	637	186471	648
8	46177	671	66950	651			87686	670	102367	669									148571	658	168834	657	187120	649
9	46848	671	67621	671			88356	670	103037	670									149231	660	169324	490	187770	650
10	47519	671	68290	669			89025	669	103706	669									149825	594	169974	650	188420	650
11	48191	672	68961	671			89694	669	104375	669									150483	658	170624	650	189070	650
12	48863	672	69631	670			90363	669	105043	668			122667	669					151141	658	171276	652	189719	649
13	49534	671	70302	671			91033	670	105712	669			123336	669					151798	657	171927	651	190368	649
14	50205	671	70974	672			91701	668	106392	680			124004	668					152454	656	172578	651	191016	648
15	50876	671	71645	671			92325	624	107071	679			124673	669	125553	658			153110	656	173227	649	191666	650
16	51547	671	72317	672			92994	669	107762	691			124895	222	126211	658			153766	656	173877	650	192315	649
17	52218	671	72989	672			93663	669	108442	680					126869	658			154423	657	174527	650	192965	650
18	52888	670	73661	672			94333	670	109112	670					127527	658			155078	655	175176	649	193615	650
19	53559	671	74333	672			95003	670	109782	670					128184	657			155733	655	175824	648	194263	648
20	54229	670	75005	672			95673	670	110451	669					128841	657	136719	658	156390	657	176472	648	194911	648
21	54899	670	75677	672			96344	671	111121	670					129499	658	137377	658	157035	645	177119	647	195561	650
22	55569	670	76348	671			97012	668	111790	669					130157	658	138035	658	157693	658	177339	220	196211	650
23	56238	669	77020	672			97681	669	112459	669					130815	658	138694	659	158348	655	177987	648		
24	56908	670	77691	671			98350	669	113128	669					131493	678	139352	658	159006	658	178635	648		
25	57579	671	78362	671			99019	669	113749	621					132171	678	140010	658	159661	655	179285	650		
26	58250	671	79034	672			99688	669	114417	668					132850	679	140667	657	160316	655	179933	648		
27	58921	671	79705	671			100358	670	115086	669					133528	678	141325	658	160972	656	180581	648		
28	59592	671	80375	670					115755	669					134206	678	141983	658	161627	655	181230	649		
29	60262	670							116425	670					134884	678	142642	659	162282	655	181287	57		
30	60931	669							117094	669					135561	677	143302	660	162940	658	181935	648		
31	61600	669							117763	669					136239	678			163598	658				

Water Discharge Licence Lwat 48 South - 2022

	JANUARY 2022		FEBRUARY 2022		MARCH 2022		APRIL 2022		MAY 2022		JUNE 2022		JULY 2022		AUGUST 2022		SEPTEMBER 2022		OCTOBER 2022		NOVEMBER 2022		DECEMBER 2022	
Date	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P	M.R	W.P
	CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES		CU METRES	
1			263492	678	272875	525					284425	688					296229	635			310172	652	316925	540
2			264119	627																	310760	588		
3	259214	688													292022	582			300112	680	311414	654		
4			264763	644	273330	455	275470	523	281095	234														
5	259789	575					275970	500					288823	655										
6							276312	342																
7			265284	521			276751	439			285102	677					296815	586	300790	678	312033	619		
8			265643	359			277173	422					298484	661	292660	638								
9			266328	685					281773	678													317395	470
10			267002	674																				
11			267668	666	273734	404	277491	318					290123	639					301395	605	312704	671		
12			268342	674											292312	652					313342	638		
13			268885	543			278113	622	282467	694														
14	260478	689	269339	454			278733	620			285708	606					297467	652	302052	657			317825	430
15							279346	613													314008	666	318503	678
16			269799	460			279957	611							293728	416							319162	659
17	261129	651	270400	601															302640	588	314663	655		
18													290559	436					303182	542				
19			270947	547											294314	586			303859	677			319828	666
20							280535	578	283120	653							298144	677	304387	528			320506	678
21	261559	430			274322	588					286304	596							304996	609	315341	678	321141	635
22																	298794	650	305651	655			321785	644
23			271530	583	274947	625													306283	632			322465	680
24	262159	600									286901	597							306961	678	315797	456	323146	681
25			272019	489											294919	605			307635	674				
26									283737	617			290851	292					308293	658				
27	262814	655					280861	326											308927	634				
28			272350	331							287566	665					299432	638	309520	593			323682	536
29											288168	602	291440	589							316385	588	324326	644
30															295594	675							324993	667
31																								

APPENDIX 9

APPENDIX 9-1

DISPERSION MODELLING OF AIR EMISSIONS FOR A RANGE OF PARAMETERS AT MCCAFFREY & SONS QUARRY, BALLINTRA, CO. DONEGAL ON BEHALF OF EARTH SCIENCE PARTNERSHIP IN FULFILMENT OF THE REQUIRMENTS OFAN AIR DISCHARGE LICENCE (REFERENCE NO.05/01)

For the Attention of:
Mr. Adrian Brittan
P McCaffrey & Sons Ltd.
Ballymagroarty Quarries
Ballintra
Co. Donegal

Prepared by:
Mr. Sean Creedon
Environmental Consultant

Reviewed by:
Ms Lisa Blyth
Operations Manager

Report No: ECS2018
Date: November 2006

Executive Summary

Bord na Móna Technical Services was commissioned by Earth Science Partnership on behalf of P.McCaffreys & Sons Ltd., Ballymogroarty Quarries, Ballintra, Co. Donegal to carry out air dispersion modelling of the significant emissions from an existing Bitmac stack in operation to demonstrate compliance with the air discharge licence for this facility. The modelling was carried out subsequent to a monitoring event undertaken during August of 2006. Using the emission data measured during this period, emission rates for a number of parameters were inputted into the dispersion model. These parameters included particulates (TSP), carbon monoxide (CO), nitrogen dioxides (NO_2), sulphur dioxide (SO_2) and volatile organic compounds (VOC's) that included benzene, toluene, xylene and remaining VOC's (RVOC's) that was as a worst case assumed to comprise of Naphthalene only. The results of this survey were used to conduct an impact assessment of emissions on the surrounding locality, and in particular on the boundary and nearest sensitive receptors. Comparison of the predicted impact of each parameter on ambient air quality is made to the appropriate Irish or EU limit values as outlined in the air discharge licence.

The impact assessments are presented in the form of concentration contours produced using US EPA approved dispersion modelling techniques (Industrial Source Complex Short Term 3 - ISCST3). Concentration contours are plotted on Ordnance Survey Maps of the locality indicating maximum odour concentrations (using a year of hourly meteorological data). Meteorological data from Belmullet Meteorological Station, covering the years 1997 - 2001 was used in the modelling exercise.

The dispersion modelling of all parameters demonstrated compliance with the required standards at both the maximum ground level impact point and also at the three local sensitive receptors around the site.

In conclusion, based on the measured emission rates for the selected compounds determined in August by Bord na Móna, the incorporation of these emission rates into the dispersion model and comparison with the appropriate air quality standards, it is contended that the impact on ambient air quality in the locality from the operation of the asphalt plant is not significant.

Respectively submitted,

Mr. Sean Creedon	Ms. Lisa Blyth
Environmental Consultant	Operations Manager

TABLE OF CONTENTS

1.0 INTRODUCTION

2.0 STACK EMISSION MEASURMENT AND ANALYSIS

3.0 DISPERSION MODELLING DESCRIPTION

4.0 DISPERSION MODELLING ASSESSMENT

- 4.1 Introduction
- 4.2 Source Input data

5.0 DISPERSION MODELLING RESULTS

- 5.1 Nitrogen Dioxide (NO_2)
- 5.2 Sulphur Dioxide (SO_2)
- 5.3 Total Suspended Particulates (TSP)
- 5.4 Carbon monoxide (CO)
- 5.5 Benzene
- 5.6 Toluene
- 5.7 Xylenes
- 5.8 Remaining VOC's

6.0 DISCUSSION

7.0 CONCULSION

1.0 INTRODUCTION

Bord na Móna Technical services was contacted by Earth Science Partnership on behalf of P McCaffrey & Sons Ltd to carry out sampling and analysis of the emissions arising from the operation of the asphalt plant at Ballymagroarty, Ballintra, Co Donegal. Following this monitoring programme, dispersion modelling of the significant parameters was carried out to determine the potential impact on ambient air quality in the surrounding locality. The sampling and dispersion modelling of this emission source was carried out as part of the existing requirements of air discharge licence for this emission point.

The limits of the air discharge licence are stated as follows in section 4.4:

'Activities on site shall not give rise to ambient air concentrations which exceed the following limits:'

PARAMETER	*AMBIENT CONCENTRATION LIMIT ($\mu g/m^3$)*	*AVERAGING PERIOD*
Nitrogen Dioxide	*200*	*Hourly average*
Sulphur Dioxide	*350*	*Hourly average as a 99.7 percentile*
Carbon Monoxide	*10,000*	*8 hour average*
Benzene	*5*	*Annual average*
Toluene	*300*	*Hourly average as a 99 percentile*
Xylenes	*300*	*Hourly average as a 99 percentile*
Naphthalene	*40*	*Hourly average as a 99 percentile*

The discharge licence also states in 5.1 that a range of emission parameters are to be monitored and in 5.2 that these emissions should be inputted into a dispersion model. 5.2 states:

'The predicted ground level concentrations of sulphur dioxides, nitrogen dioxides, particulates and benzene shall be compared with the relevant air quality standards set out in the Air Quality Standards Regulations, 2002(S.I. No. 2001(**271**) *of 2002). The predicted increase in ground level concentrations of xylene, toluene and naphthalene shall be compared with the Danish EPA C-values.'*

Where two different limit values are proposed for a single parameter under the above conditions the lower of the two is applied in this report.

The impact assessment is presented in the form of odour concentration contours produced using US EPA approved dispersion modelling techniques (Industrial Source Complex Short Term 3 - ISCST3). Concentration contours are plotted on Survey Maps of the locality indicating maximum odour concentrations (using a year of hourly meteorological data). Meteorological data from the Belmullet Meteorological Station covering the years 1997 – 2001 was used in the modelling exercise.

This report details the findings of this assessment together with a description of the dispersion model used.

2.0 STACK EMISSION MEASUREMENT AND ANALYSIS

Stack emission monitoring on the asphalt plant stack was carried out by Bord na Móna Technical Services for a range of parameters. These included nitrogen dioxide, sulphur dioxide, total suspended particulates, carbon monoxide and VOC's including benzene, toluene, xylene and Naphthalene. The sampling methodology and results of this stack monitoring programme are outlined in sections 2.1 to 2.2.

2.1 Sampling Methodology

Emission volumes and release temperatures

Emission volumes were determined from stack velocity measurements calculated using either a pitot tube and manometer or the Gravimat in accordance with the British Standard BS3405. Temperature measurements were also recorded to coincide with the collection of stack gas samples.

Total Suspended Dust and Particulates

The particulate matter emissions were determined isokinetically using a Gravimat isokinetic sampler. The monitoring was carried out based on BS3405. Each sample wasbe collected over a minimum 30-minute period. Subsequently, the filters were brought to the Bord na Móna laboratory complex where the filters were weighed using a 5-point calibrated balance. The results are expressed in mg/Nm^3.

Volatile Organic Compounds

The sampling and analysis of Volatile Organic Compounds were conducted in accordance with the following procedure. Samples were collected by adsorption onto charcoal tubes over a 30-minute period using specialised SKC sample pumps set at a flow rate of approximately 200ml/min. Following desorption, the tubes were analysed using Gas Chromatography Mass Spectrometry. This system consists of an Agilent 6890N Gas Chromatograph interfaced with an Agilent 5973 Network Mass Spectrometer Detector and equipped with a high resolution capillary column allowing for the detection and resolution of those components expected to be present. All results are expressed in mg/Nm^3 and kg/hr.

Flue Gas Analysis

Carbon monoxide (CO), nitrogen oxides (NOx) and sulphur dioxide (SO_2) emissions were monitored using a Combustion Efficiency Analyzer. This instrument is a technically perfected multimeter with detection by means of electrochemical sensors. To protect the sensors the flue gas is passed through a fine dust filter. The results are expressed in mg/Nm^3.

2.2 Sampling Results

TABLE 2.2.1 STACK EMISSION MONITORING ERESULTS			
Parameter	**Conc.**[Note 1]	**Stack Temperature**[Note 2]	**Volumetric Flow rate**[Note 3]
	mg/m^3	C	m^3/s
NOx	26.35	85	8.899
SO_2	1.77		
CO	474.02		
TSP	5.285		
Benzene	0.00198		
Toluene	0.00035		
Xylenes	<0.00019		
Remaining VOC's	<0.00019		

Note 1 Results are an average of triplicate sampling or triplicate monitoring runs
Note 2 This is an average temperature recorded over the sampling period.
Note 3 This is an average flowrate recorded over the sampling period

3.0 DISPERSION MODELLING DESCRIPTION

3.1 Model Selection and Description

Dispersion modelling is a technique for calculating concentrations of pollutants that are the result of emissions. Several varying types of models exist depending on the type of application and dispersion equation used. The model chosen for this study was the Industrial Source Complex Short term Dispersion Model (ISCST3). This model is recommended for an industrial source such as a power station (40CFR Chap 1, Part 51, Appendix W USEPA).

The Industrial Source Complex Short-Term 3 (ISCST3) model is a refined air dispersion model used to predict pollutant concentrations from a wide range of sources that may be present at typical industrial facilities. The basis of the model is the straight-line, steady-state Gaussian plume equation, which is used with some modifications to model simple point source emissions from stacks that experience the effects of aerodynamic downwash due to nearby buildings, isolated vents, multiple vents, storage piles, conveyor belts, and the like. Essentially, emission sources are categorised into four basic types of sources, i.e., point sources, volume sources, area sources, and open pit sources.

The ISCST3 Model accepts hourly meteorological data records to define the conditions for plume rise, transport, diffusion, and deposition. Depending on the location of the facility the appropriate meteorological data is chosen. The model also takes into account the local terrain surrounding the facility. The model estimates the concentration or deposition value for each source and receptor combination for each hour of input meteorology, and calculates user-selected short term averages. In addition, since most air quality standards are stipulated as averages or percentiles the ISCST3 model allows further analysis of the results for comparison with these standards.

3.2 Terrain Description

Simple Terrain

If a receptor is located in terrain that is less than or equal to the physical release height, then that receptor is defined as being in simple terrain for that hour and that source, and the concentration is based on the simple terrain algorithm only.

Complex Terrain

If the terrain height is equal to or exceeds the plume height, then a receptor is defined as being located in complex terrain for that hour and that source, and the concentration is based on the complex terrain dispersion algorithm from the COMPLEX 1 model. The ISCST3 model uses a steady state, sector-averaged Gaussian plume equation for applications in complex terrain. The complex terrain screening algorithms apply only to point source and volume source emissions: area source and open pit emission sources are omitted. COMPLEX 1 uses only the Pasquill-Gifford dispersion coefficients and, therefore, should be used only for rural areas.

Intermediate Terrain

In the ISCST3 model, intermediate terrain is defined as terrain that exceeds the height of the release, but is below the plume centreline height. A receptor is said to be located in intermediate terrain if its elevation is greater than stack top elevation but less than plume centreline elevation. For intermediate terrain receptors, concentrations from both the simple terrain algorithm and the complex terrain algorithm are obtained and the higher of the two concentrations is used for that hour and that source.

For the purpose of this modelling assessment elevated terrain data was used. The terrain heights ranged from 82 meter to 126 meters.

3.3 Sources

The single emission point used for this exercise was the asphalt plant stack. This source can be classified as a point source.

3.3.*1* *Point Sources*

A point source is a source that releases effluent pollutants from a limited opening, such as a stack or vent. The ISCST3 model for stacks uses the steady-state Gaussian plume equation for a continuous elevated source. For each source and each hour, the origin of

the source's coordinate system is placed at the ground surface at the base of the stack. The fixed receptor locations are converted to each source's coordinate system for each hourly concentration calculation. The hourly concentrations calculated for each source at each receptor are, subsequently summed to obtain the total concentration produced at each receptor by the combined source emissions.

3.4 Receptor Locations

A single receptor grid was used during the modelling assessment.

Receptor Grid

A Cartesian receptor grid was constructed of 39 x 28 receptor points spaced 30 metres apart. The co-ordinates of these receptor grid corners are given below:

NE Corner	(191340, 267860) [Easting, Northing]
NW Corner	(190200, 267860) [Easting, Northing]
SW Corner	(190200, 267050) [Easting, Northing]
SE Corner	(191340, 267050) [Easting, Northing]

In addition, discrete receptors were located at various points on the boundary of the site.

The elevations of the receptor locations were obtained from a survey drawing obtained from Earth Science partnership. Elevations were taken from map contours and bench marks throughout the area of the receptor grid. Terrain heights were taken into account for all of the modelling undertaken.

Sensitive receptor grid co-ordinates (SR1 to SR3) were determined based on a supplied OS map of the area surrounding the site. (See Figure 4.1 and Table 4.1.1).

3.5 Meteorological Data

The meteorological data for the five years from 1997 to 2001 for Belmullet Meteorological Station was obtained. This is the nearest representative station to the Ballintra site. A graphical depiction of the frequency of wind speed and wind direction for the combined five years is included below.

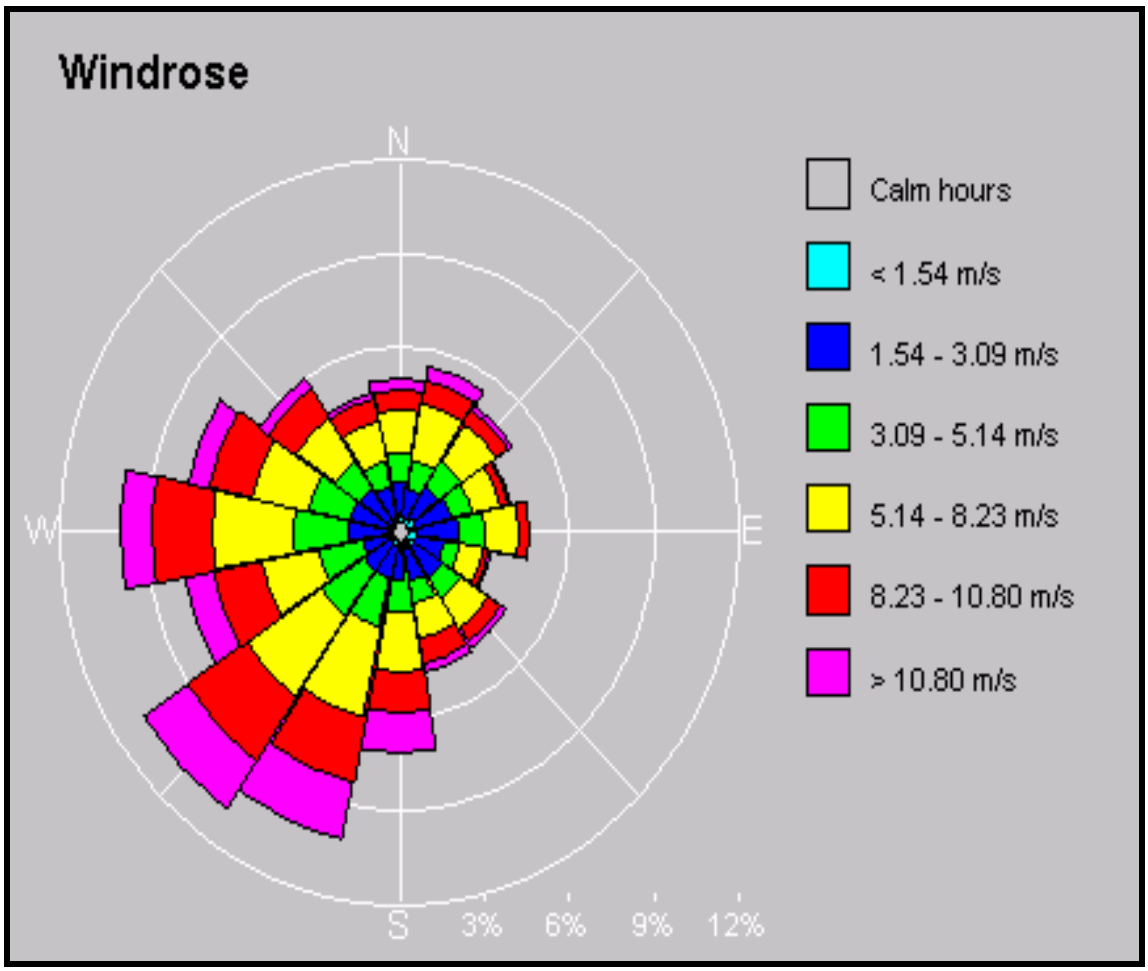


Fig 3.5.1 Windrose for Bellmullet 1997 to 2001

4.0 DISPERSION MODELLING ASSESSMENT

4.1 Introduction

A detailed modelling assessment of the present emissions was carried out to assess the impact on the surrounding locality. The emission level and mass emission rate varies for each of the chosen parameters. The sensitive receptors are highlighted in Figure 4.1 below and their locations described in Table 4.1.

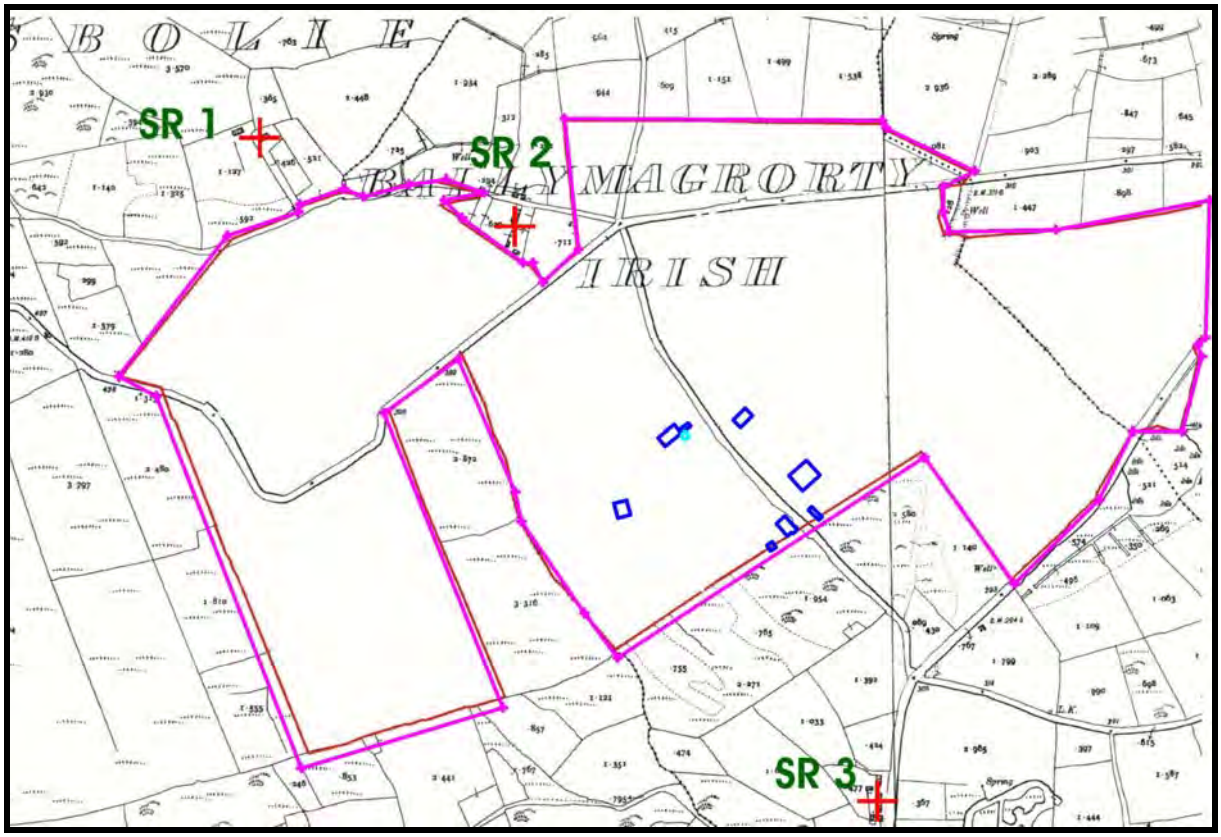


Fig 4.1 Site and sensitive receptor locations

Table 4.1.1 Location of selected Sensitive receptors		
Receptor No.	Grid reference	Description
SR1	190443, 267731	North of the Site
SR2	190681, 267647	North of the Site
SR3	191021, 267104	South of the Site

4.2 Source Input Data

Tables 4.2.1 to 4.2.9 detail the input data for the parameters at the site for the potential impact.

TABLE 4.2.1 INPUT DATA FOR NO_2 EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	26.35[Note 1]
Volume Flow (m^3/s)	8.99[Note 1]
Mass Emission Rate (g/s)	0.23447
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.2 INPUT DATA FOR SO_2 EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	1.77[Note 1]
Volume Flow (m^3/s)	8.99[Note 1]
Mass Emission Rate (g/s)	0.01572
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.3 INPUT DATA FOR TSP EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	5.29[Note 1]
Volume Flow (m^3/s)	8.99[Note 1]
Mass Emission Rate (g/s)	0.047033
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.4 INPUT DATA FOR CO EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	474.02[Note 1]
Volume Flow (m^3/s)	8.99[Note 1]
Mass Emission Rate (g/s)	4.218
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.5 INPUT DATA FOR BENZENE EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	0.00198[Note 1]
Volume Flow (m^3/s)	8.99[Note 1]
Mass Emission Rate (g/s)	0.00001761
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.6 INPUT DATA FOR TOLUENE EMISSION	
Parameters	
Source	**Asphalt plant stack**
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	0.00035 Note 1
Volume Flow (m^3/s)	8.99 Note 1
Mass Emission Rate (g/s)	0.00000313
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

TABLE 4.2.7 INPUT DATA FOR XYLENE EMISSION	
Parameters	
Source	Asphalt plant stack
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	0.00019 Notes 1, 2
Volume Flow (m^3/s)	8.99 Note 1
Mass Emission Rate (g/s)	0.00000165
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

Note 2: Less than the limit of detection – used the maximum value possible

TABLE 4.2.8 INPUT DATA FOR REMAINING VOC EMISSION	
Parameters	
Source	Asphalt plant stack
Base Elevation (m)	95.55
Max. Stack Temperature (^oC)	85
Stack Height (m)	17.8
Diameter (m)	0.85
Emission level (mg/m^3)	0.00019 Notes 1, 2
Volume Flow (m^3/s)	8.99 Note 1
Mass Emission Rate (g/s)	0.00000165
Periods of Operation	Worse case of Continuous emission

Note 1: Un-normalised measured value

Note 2: Less than the limit of detection – used the maximum value possible

5.0 DISPERSION MODELLING RESULTS

This section outlines the results of the modelled impact on ambient air quality with comparison to the relevant national and EU air quality standards (where possible).

5.1 NO_2

Tables 5.1.1 and 5.1.2 below and overleaf outline the impact of the emissions of NO_2 ambient air quality

Table 5.1.1 Air Quality Impact Assessment – NO_2

Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	Maximum predicted ground level concentration ($\mu g/m^3$)	Grid Ref
S.I No. 271 of 2002 Protection of Human Health	1hour	200 (not more than 18 times a year)	24.36	190560, 267440
S.I No. 271 of 2002 Protection of Human Health	Calendar Year	40	0.359	190440, 267470
S.I No. 271 of 2002 Protection of Vegetation	Calendar Year	30	0.359	190440, 267470

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

The contour plots illustrating the annual average impact (Figure 5.1.1) and the hourly average impact (Figure 5.1.2) can be found overleaf.

Table 5.1.2 Air Quality Impact at selected sensitive receptors – NO_2					
Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	SR1 ($\mu g/m^3$)	SR2 ($\mu g/m^3$)	SR3 ($\mu g/m^3$)
S.I No. 271 of 2002 Protection of Human Health	1hour	200 (not more than 18 times a year)	9.37	2.92	2.97
S.I No. 271 of 2002 Protection of Human Health	Calendar Year	40	0.236	0.119	0.027
S.I No. 271 of 2002 Protection of Vegetation	Calendar Year	30	0.236	0.119	0.027

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

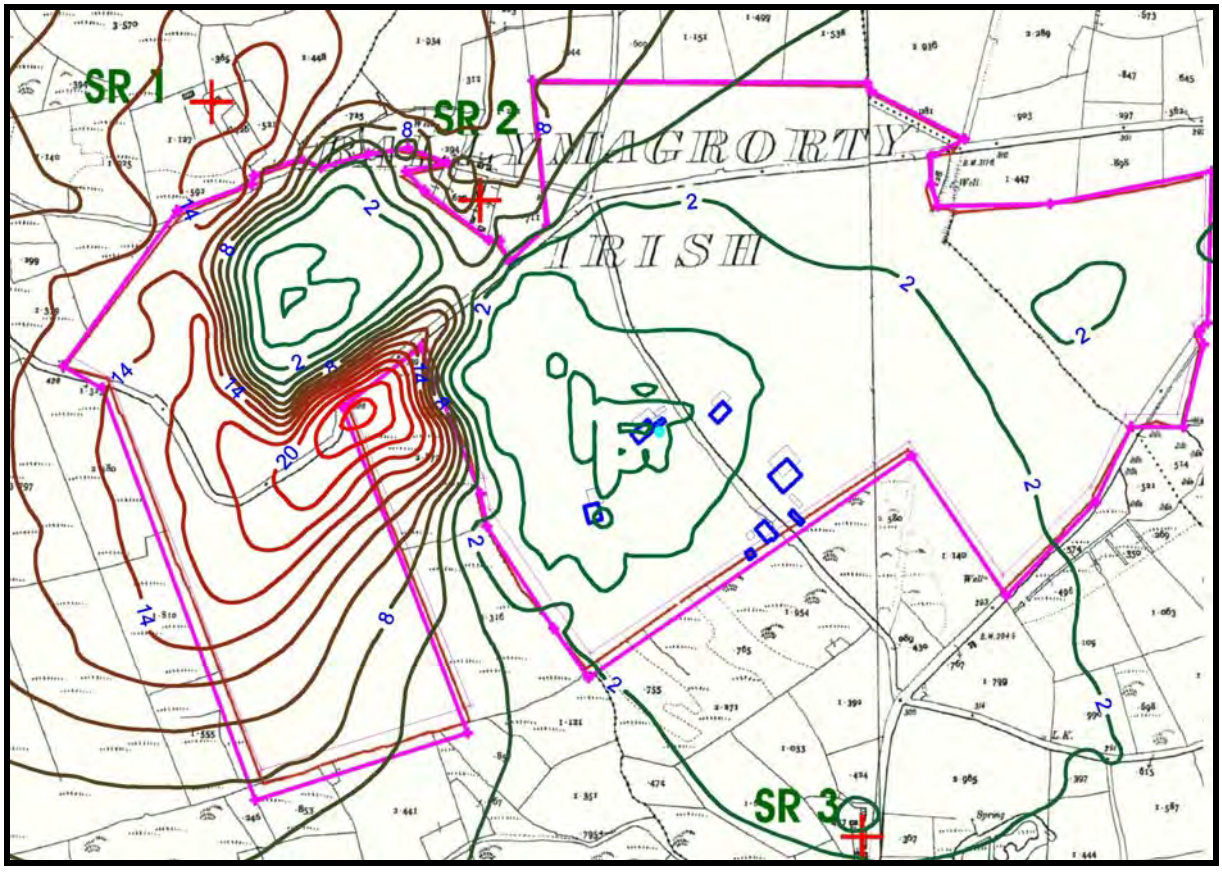


Figure 5.1.1 Maximum predicted ground level NO_2 ($\mu g/m^3$) concentration as a 99.8 percentile Hourly average

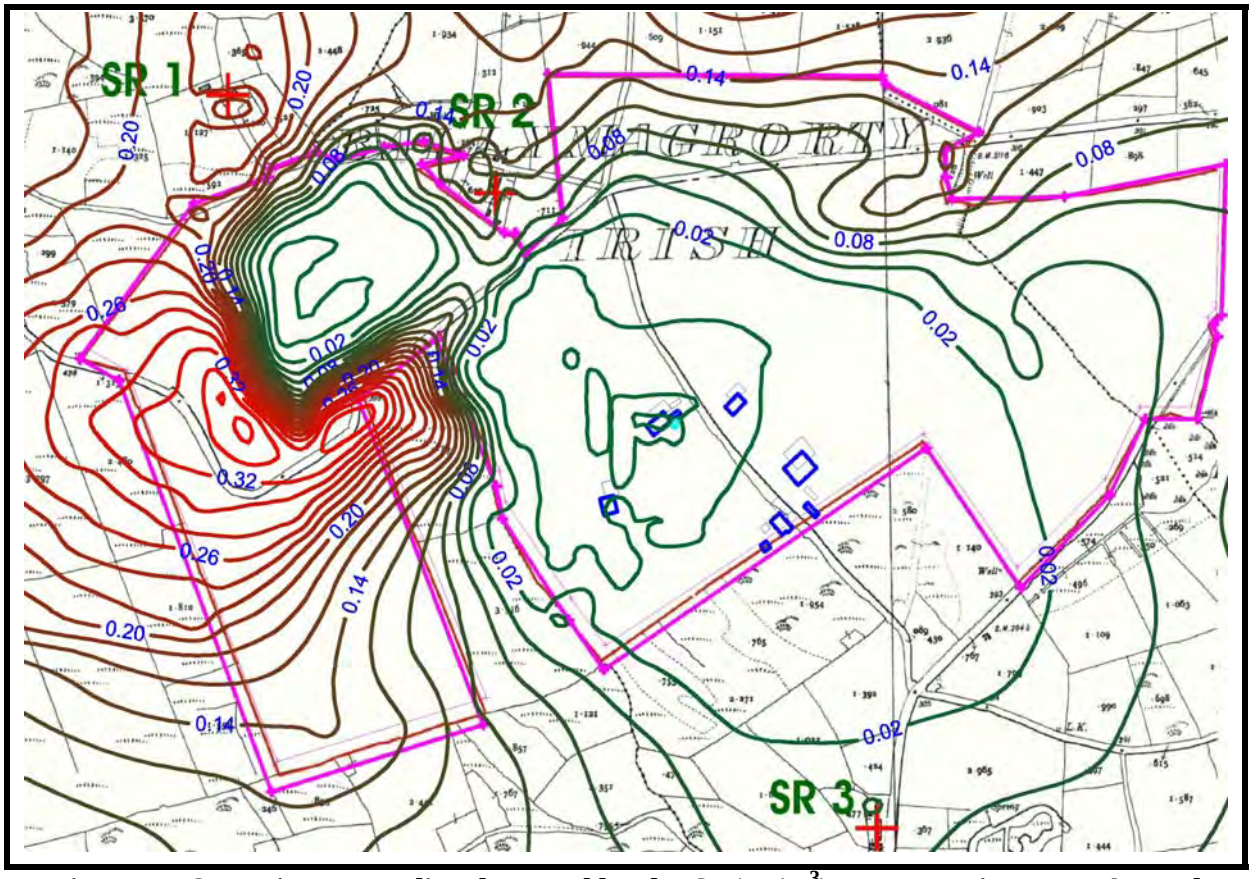


Figure 5.1.2 Maximum predicted ground level NO_2 (µg/m^3) concentration as an Annual average

5.2 SO_2

Tables 5.2.1 and 5.2.2 below outline the predicted impact of SO_2 and compares the predicted ambient levels to the relevant standard.

Table 5.2.1 Air Quality Impact Assessment – SO_2

Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	Maximum Predicted ground level concentration ($\mu g/m^3$)	Grid Ref
S.I No. 271 of 2002 Protection of Human Health	1hour	350 (not more than 24 times a year)	1.546	190560, 267440
S.I No. 271 of 2002 Protection of Human Health	24 hours	125 (not more than 3 times a year)	0.436	190560, 267440
S.I No. 271 of 2002 Protection of Vegetation	Year	20	0.024	190440, 267470

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

The contour plots illustrating the annual average impact (Figure 5.2.1), the hourly average impact (Figure 5.2.2) and the daily average impact (Figure 5.2.3) can be seen overleaf.

Table 5.2.2 Air Quality Impact at selected sensitive receptors – SO_2

Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	SR1 ($\mu g/m^3$)	SR2 ($\mu g/m^3$)	SR3 ($\mu g/m^3$)
S.I No. 271 of 2002 Protection of Human Health	1hour	350 (not more than 24 times a year)	0.584	0.181	0.192
S.I No. 271 of 2002 Protection of Human Health	24 hours	125 (not more than 3 times a year)	0.133	0.0437	0.0527
S.I No. 271 of 2002 Protection of Vegetation	Year	20	0.016	0.008	0.002

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

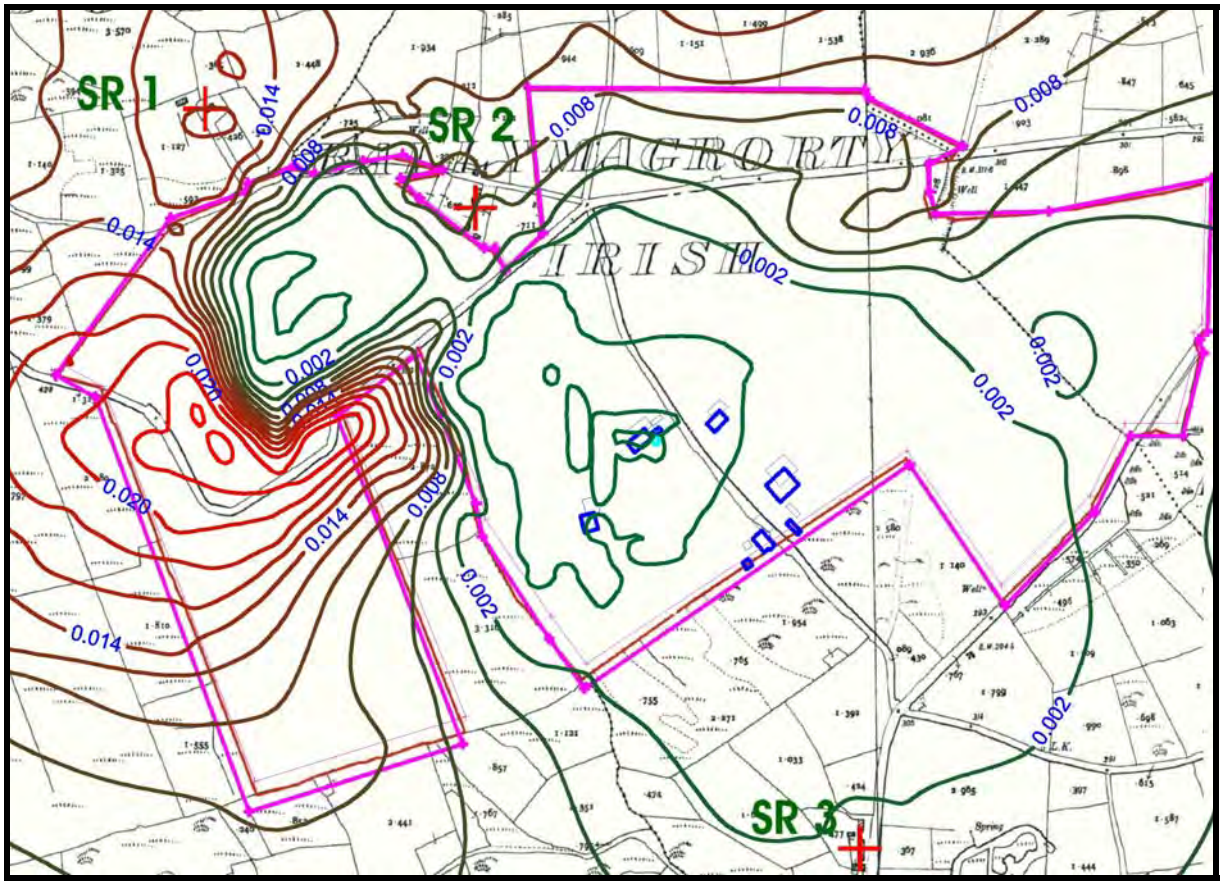


Figure 5.2.1 Maximum predicted ground level SO_2 (µg/m^3) concentration as an Annual average

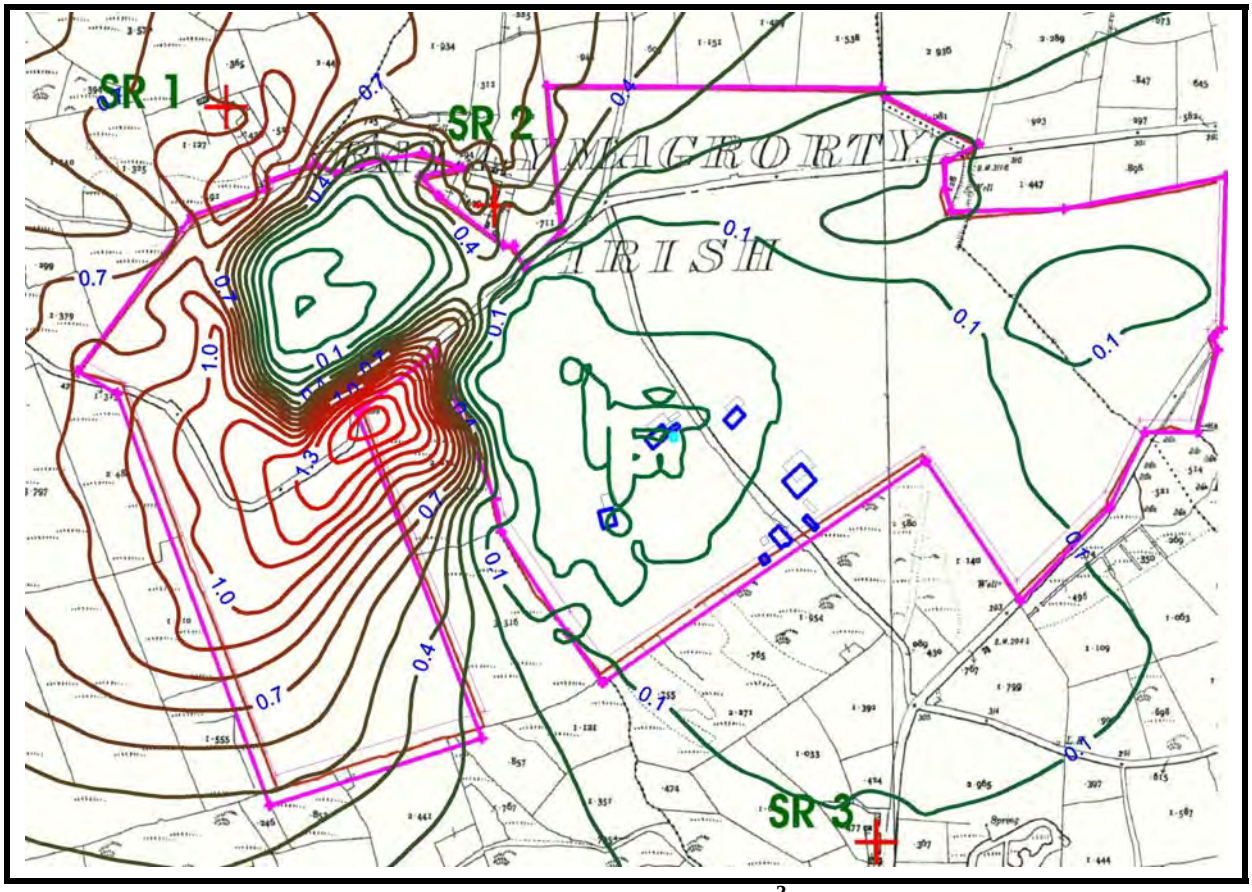


Figure 5.2.2 Maximum predicted ground level SO_2 (µg/m^3) concentration as a 99.7 % of the hourly average

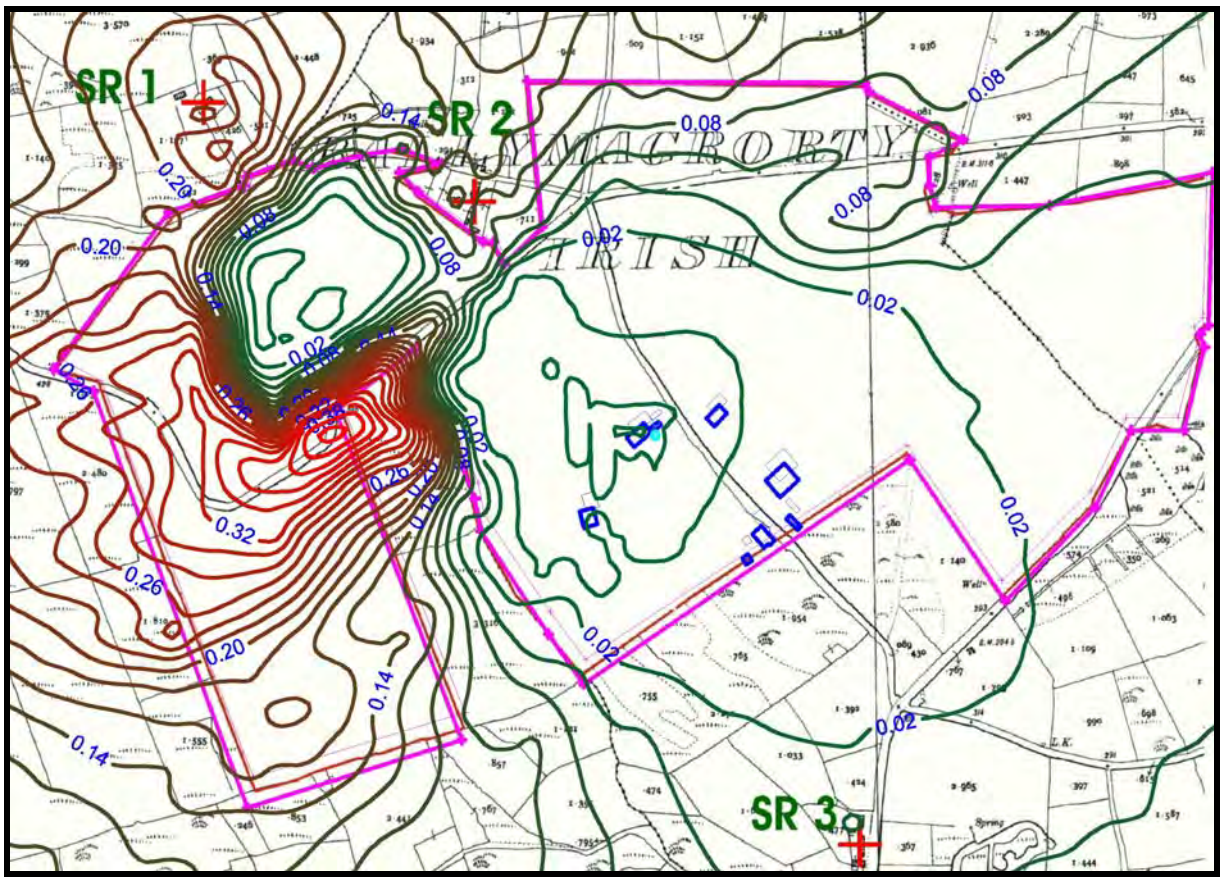


Figure 5.2.3 Maximum predicted ground level SO_2 (µg/m^3) concentration as a 99.2% of the daily average

5.3 TSP

Tables 5.3.1 and 5.3.2 below outline the predicted impact of TSP and compares the predicted ambient levels to the relevant standard.

Table 5.3.1 Air Quality Impact Assessment – TSP				
Standard[1]	Averaging period	Limit Value (µg/m3)	Maximum predicted ground level concentration (µg/m^3)	Grid Ref
S.I No. 244 (1987)	Daily	250 (As a 98%)	0.89	190470, 267440

[1]Air Pollution Act, 1987 (Air Quality Standards) Regulations 1987- S.I No. 244 of 1987

Table 5.3.2 Air Quality Impact at selected sensitive receptors – TSP					
Standard[1]	Averaging period	Limit Value (µg/m^3)	SR1 (µg/m^3)	SR2 (µg/m^3)	SR3 (µg/m^3)
S.I No. 244 (1987)	Daily	250 (As a 98%)	0.275	0.076	0.121

[1]Air Pollution Act, 1987 (Air Quality Standards) Regulations 1987- S.I No. 244 of 1987

The contour plot illustrating the daily average impact (Figure 5.3.1) is presented below.

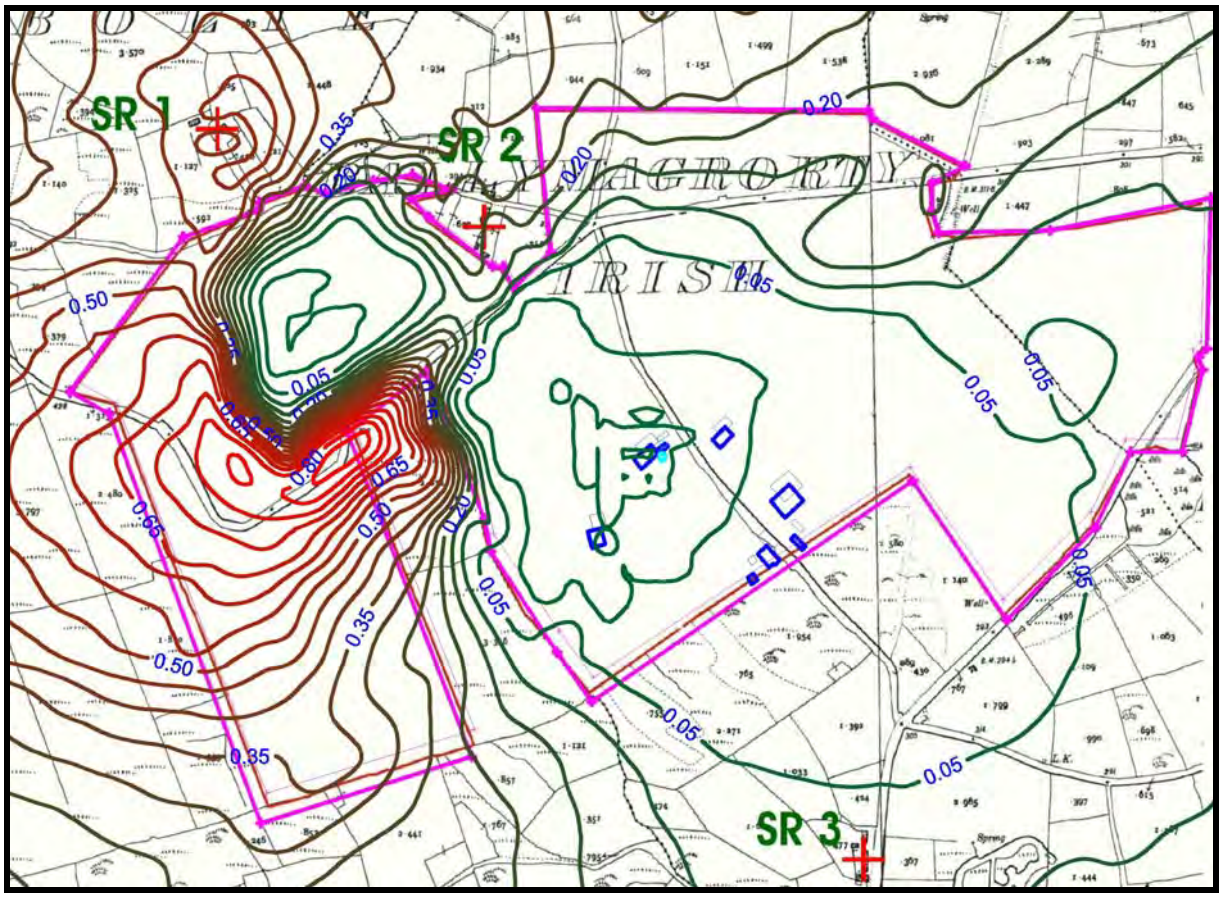


Figure 5.3.1 Maximum predicted ground level TSP (µg/m^3) concentration as a 98% of the daily average

5.4 CO

Tables 5.4.1 and 5.4.2 below outline the impact of CO and compares the predicted ambient levels to the relevant standard.

Table 5.4.1 Air Quality Impact Assessment – CO

Standard[1]	Averaging period	Maximum daily 8hr mean (mg/m^3)	Maximum predicted ground level concentration (mg/m^3)	Grid Ref
S.I No. 271 of 2002 Protection of Human Health	8 hour	10	0.316	190560, 267470

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

Table 5.4.2 Air Quality Impact at selected sensitive receptors – CO

Standard[1]	Averaging period	Maximum daily 8hr mean (mg/m^3)	SR1 (mg/m^3)	SR2 (mg/m^3)	SR3 (mg/m^3)
S.I No. 271 of 2002 Protection of Human Health	8 hour	10	0.180	0.074	0.028

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

The contour plot illustrating the impact (Figure 5.4.1) can be seen overleaf.

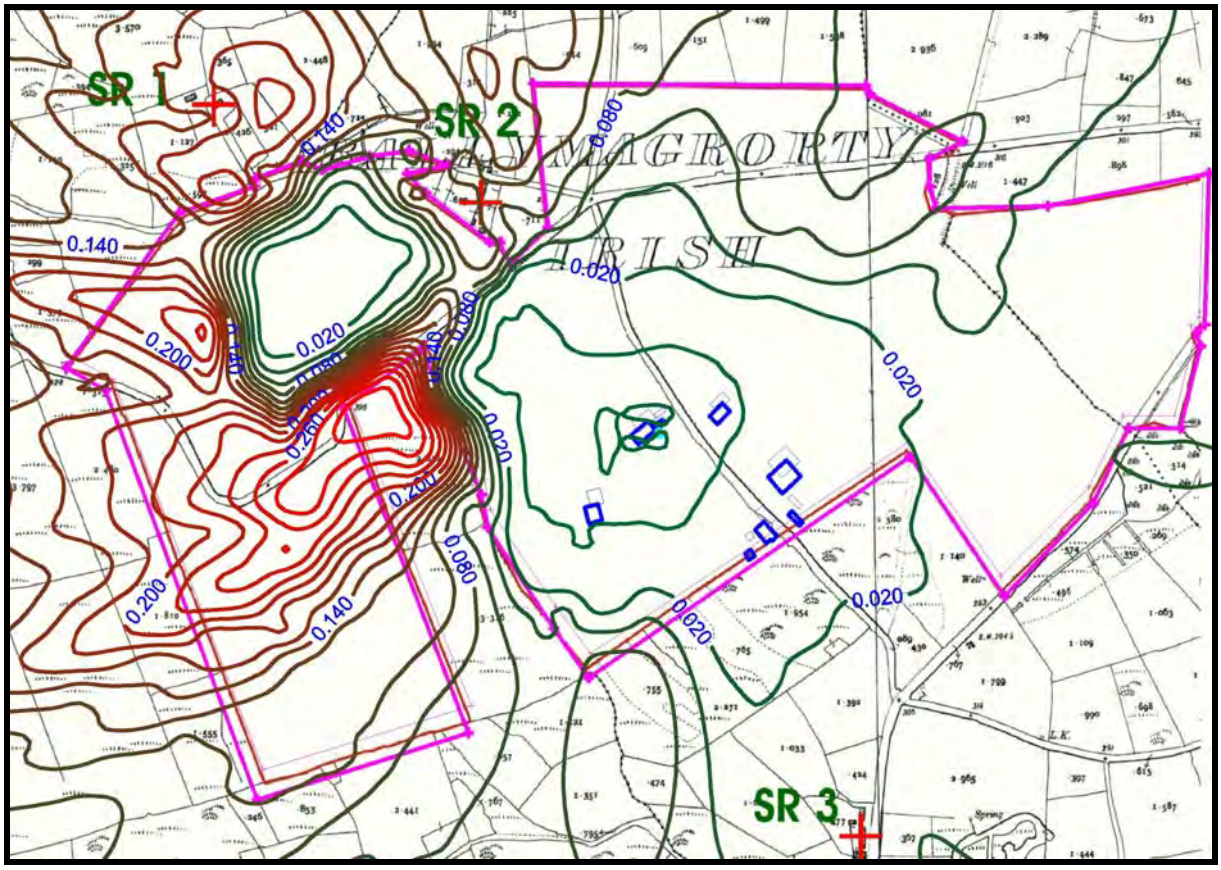


Figure 5.4.1 Maximum predicted ground level CO (mg/m^3) concentration as an 8 hour average

5.5 Benzene

Tables 5.5.1 and 5.5.2 below outlines the predicted impact of Benzene and compares the predicted ambient levels to the relevant guideline value.

Table 5.5.1 Air Quality Impact Assessment – Benzene

Standard[1]	Averaging period	Limit Value (µg/m^3)	Maximum predicted ground level concentration (µg/m^3)	Grid Ref
S.I No. 271 of 2002 Protection of Human Health	Annual	5	<0.001	190440, 267470

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

Table 5.5.2 Air Quality Impact at selected sensitive receptors – Benzene

Standard[1]	Averaging period	Limit Value (µg/m^3)	SR1 (µg/m^3)	SR2 (µg/m^3)	SR3 (µg/m^3)
S.I No. 271 of 2002 Protection of Human Health	Annual	5	<0.001	<0.001	<0.001

[1]Air Quality Standards Regulations 2002- S.I No. 271 of 2002

The contour plot illustrating the hourly average impact (Figure 5.7.1) can be found below.

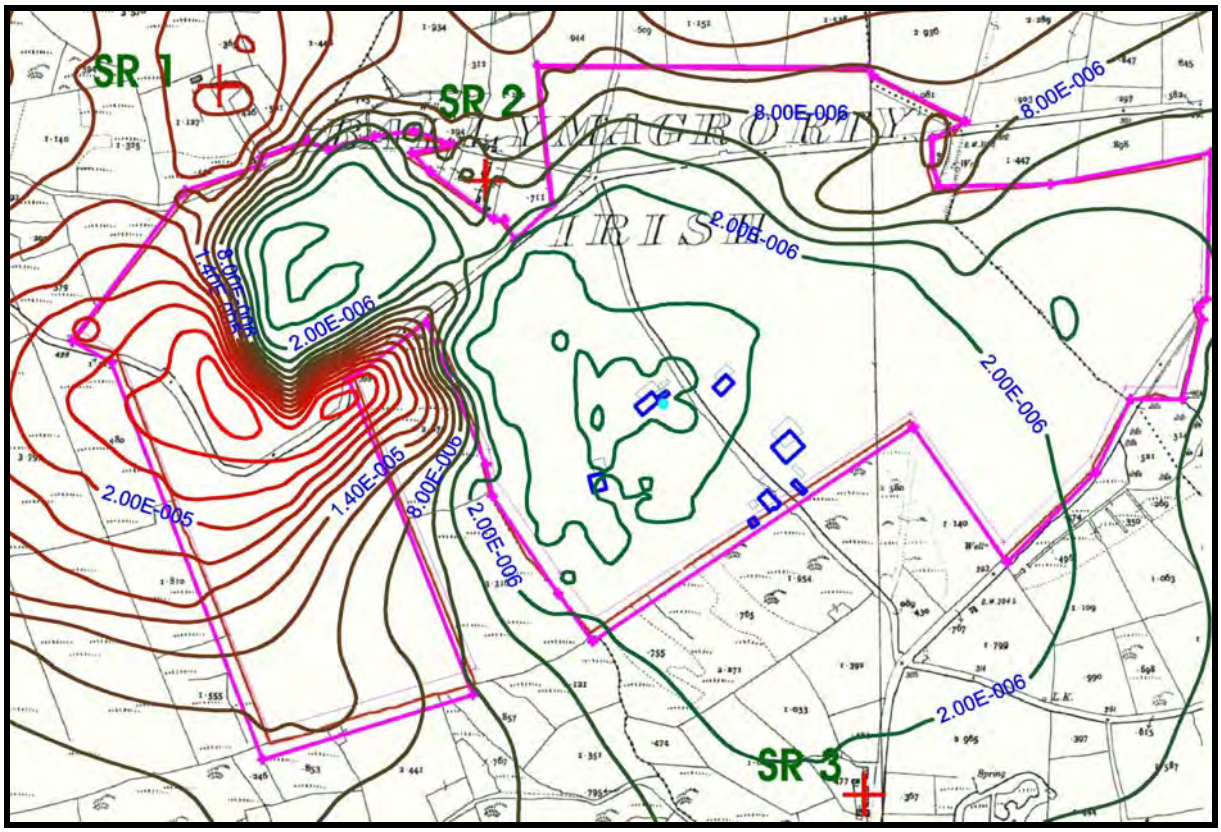


Figure 5.5.1 Maximum predicted ground level Benzene (µg/m^3) concentration as an annual average

5.6 Toluene

Tables 5.6.1 and 5.6.2 below outlines the predicted impact of Toluene and compares the predicted ambient levels to the relevant guideline value.

Table 5.6.1 Air Quality Impact Assessment – Toluene				
Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	Maximum predicted ground level concentration ($\mu g/m^3$)	Grid Ref
Danish C Value	1 hour	300 (as a 99%)	<0.001	190530, 267410

[1]Danish C-Value– Guidelines for Air Emission Regulation Danish Environmental Protection Agency

Table 5.6.2 Air Quality Impact at selected sensitive receptors – Toluene					
Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	SR1 ($\mu g/m^3$)	SR2 ($\mu g/m^3$)	SR3 ($\mu g/m^3$)
Danish C Value	1 hour	300 (as a 99%)	<0.001	<0.001	<0.001

[1]Danish C-Value– Guidelines for Air Emission Regulation. Danish Environmental Protection Agency

The contour plot illustrating the hourly average impact (Figure 5.6.1) can be found overleaf.

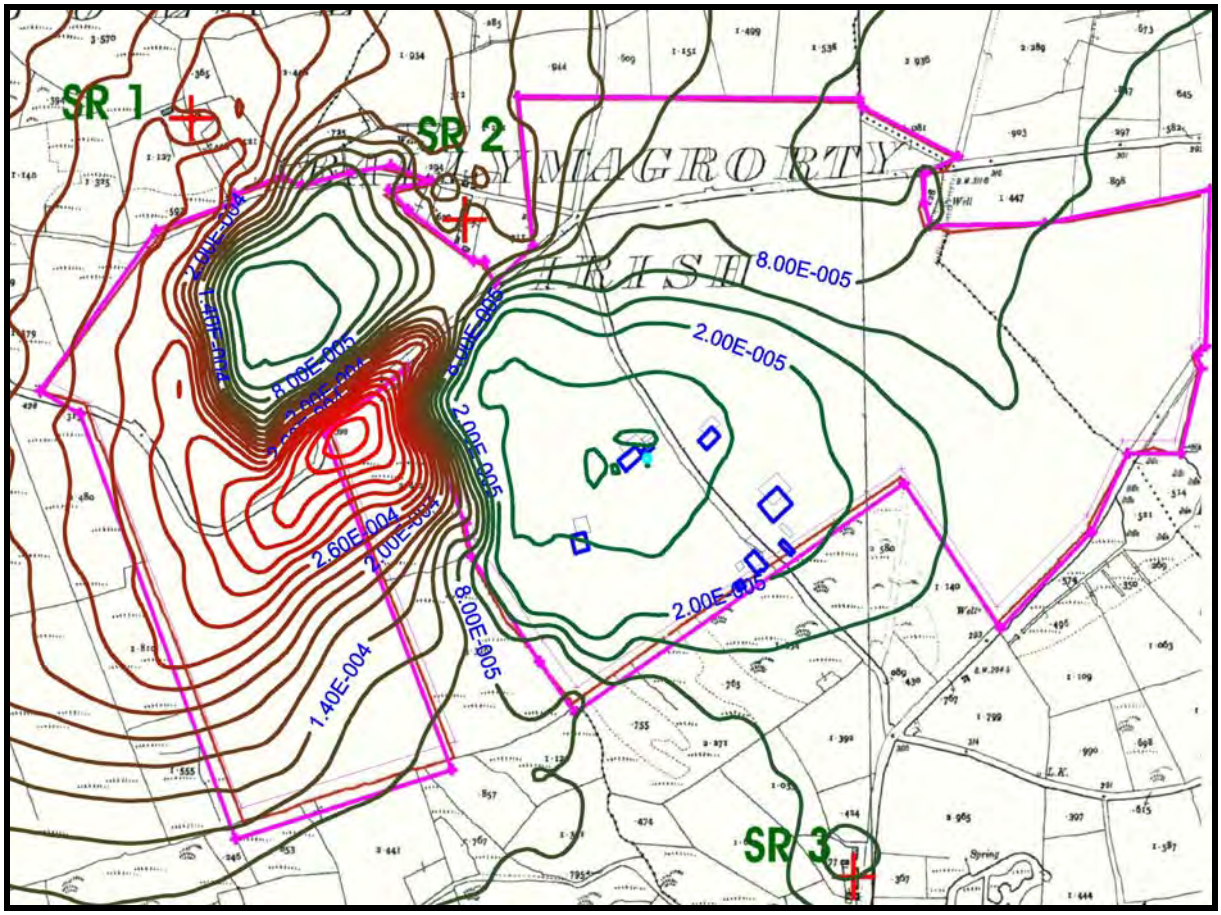


Figure 5.6.1 Maximum predicted ground level Toluene (µg/m^3) concentration as a 99% hourly average

5.7 Xylenes

Tables 5.7.1 and 5.7.2 below outlines the predicted impact of Xylenes and compares the predicted ambient levels to the relevant guideline value.

Table 5.7.1 Air Quality Impact Assessment – Xylenes				
Standard[1]	Averaging period	Limit Value (µg/m^3)	Maximum predicted ground level concentration (µg/m^3)	Grid Ref
Danish C Value	1 hour	100 (as a 99%)	<0.001	190530, 267410

[1]Danish C-Value– Guidelines for Air Emission Regulation Danish Environmental Protection Agency

Table 5.7.2 Air Quality Impact at selected sensitive receptors – Xylenes					
Standard[1]	Averaging period	Limit Value (µg/m^3)	SR1 (µg/m^3)	SR2 (µg/m^3)	SR3 (µg/m^3)
Danish C Value	1 hour	100 (as a 99%)	<0.001	<0.001	<0.001

[1]Danish C-Value– Guidelines for Air Emission Regulation. Danish Environmental Protection Agency

The contour plot illustrating the hourly average impact (Figure 5.7.1) can be found below.

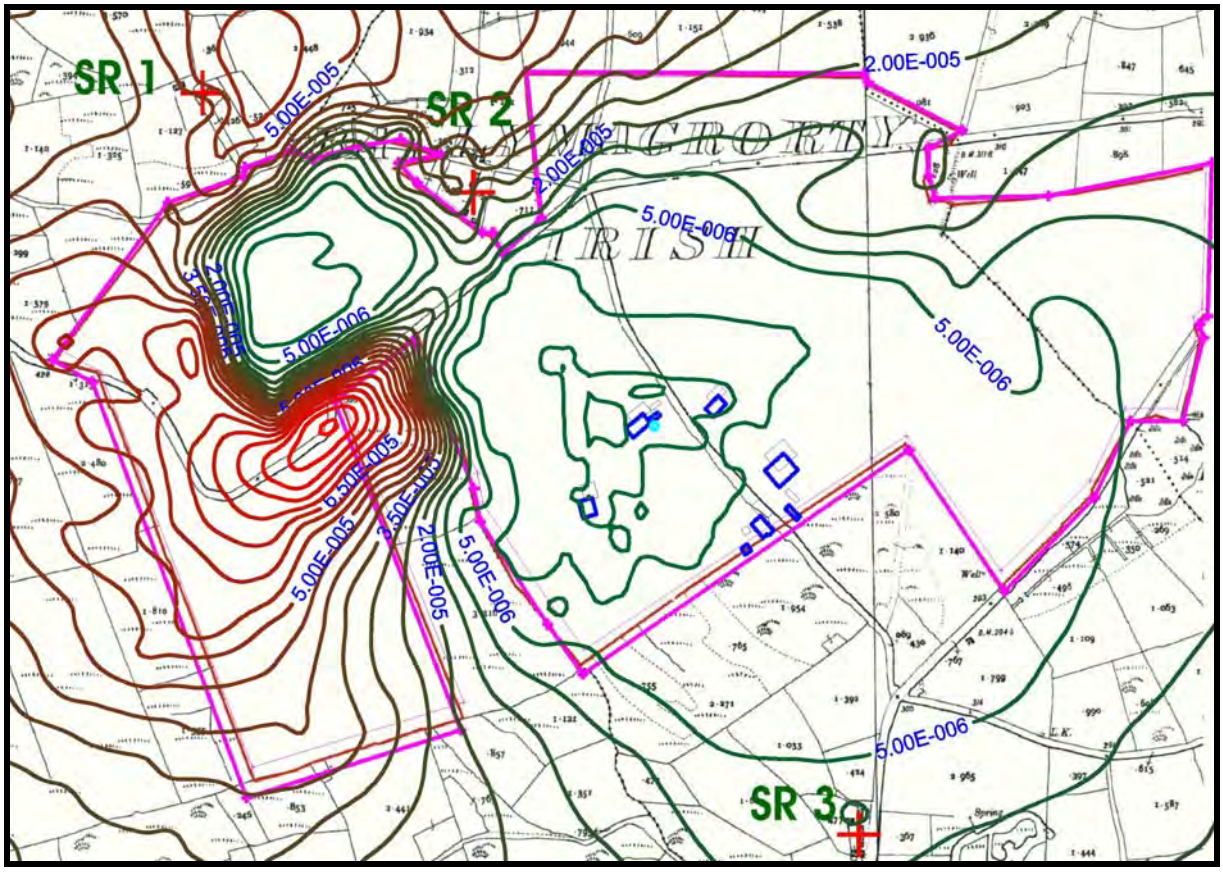


Figure 5.7.1 Maximum predicted ground level XyleneC (µg/m^3) concentration as a 99% hourly average

5.8 Remaining VOC's

Tables 5.8.1 and 5.8.2 below outlines the predicted impact of the remaining VOC's and compares the predicted ambient levels to the relevant guideline value.

Table 5.8.1 Air Quality Impact Assessment – Remaining VOC's

Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	Maximum predicted ground level concentration ($\mu g/m^3$)	Grid Ref
Danish C Value	1 hour	40 (as a 99%)	<0.001	190530, 267410

[1]Danish C-Value– Guidelines for Air Emission Regulation Danish Environmental Protection Agency

Table 5.8.2 Air Quality Impact at selected sensitive receptors – Remaining VOC's

Standard[1]	Averaging period	Limit Value ($\mu g/m^3$)	SR1 ($\mu g/m^3$)	SR2 ($\mu g/m^3$)	SR3 ($\mu g/m^3$)
Danish C Value	1 hour	40 (as a 99%)	<0.001	<0.001	<0.001

[1]Danish C-Value– Guidelines for Air Emission Regulation. Danish Environmental Protection Agency

The contour plot illustrating the hourly average impact (Figure 5.8.1) can be found overleaf.

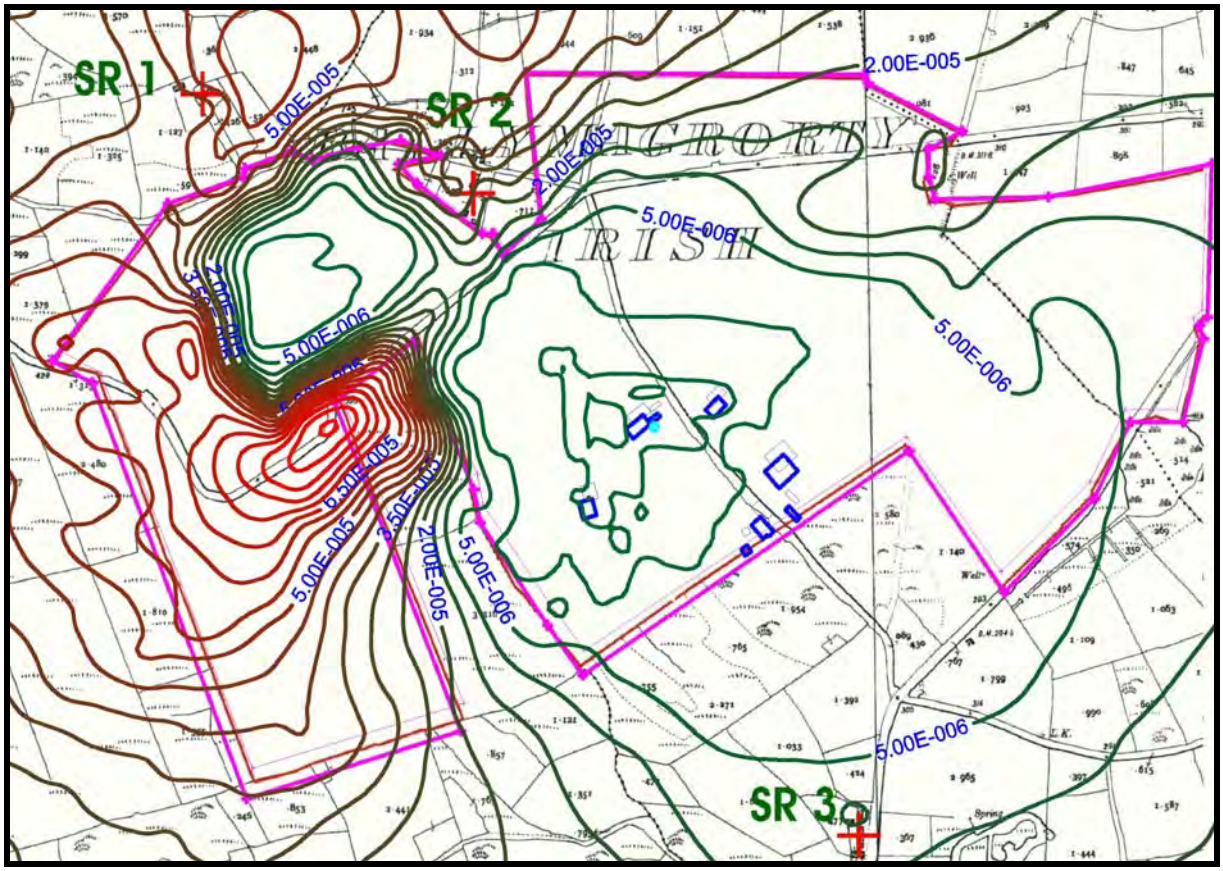


Figure 5.8.1 Maximum predicted ground level Remaining VOC's ($\mu g/m^3$) concentration as a 99% hourly average

6.0 DISCUSSION

A number of parameters were monitored by Bord na Móna Technical Services at the Ballintra Site during August 2006. The results of this monitoring program were outlined in sections 2.1 to 2.2. Following this, prediction of the ambient impact of the measured emissions was made using dispersion modelling. The impact of each of the compounds measured and modelled is summarised in Table 6.1 below.

TABLE 6.1 SUMMARY OF PREDICITED MAXIMUM GROUND LEVEL CONCENTRATIONS

Parameter	Averaging period	Maximum/Percentile	Maximum predicted impact ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)
Nitrogen Dioxide/NOx	Hourly	As a 99.8 percentile	24.36	200
	Annual	Maximum	0.359	40
	Annual (NOx)	Maximum	0.359	30
Sulphur Dioxide	Hourly	As a 99.7 percentile	1.546	350
	Daily	As a 99.1 percentile	0.436	125
	Annual	Maximum	0.024	20
Total Suspended Particulate	Daily	As a 98 percentile	0.89	250
Carbon monoxide	Maximum 8 hr running average	Maximum	316	10,000
Benzene	Annual	Maximum	<0.001	5
Toluene	Hourly	As a 99 percentile	<0.001	300
Xylene	Hourly	As a 99 percentile	<0.001	100
Naphthalene (remaining VOC's)	Hourly	As a 99 percentile	<0.001	40

CONCLUSION

A comprehensive air dispersion modelling assessment was carried out of the ground level impact of pollutants from the facility. Comparison was made with the appropriate air quality standards (national and EU, where available). Using dispersion modelling to predict the impact on ground level concentrations of the selected parameters, it has been demonstrated that all predicted impacts for all measured parameters are well within their respective limit values. Therefore it has been demonstrated that the operation of the asphalt plant stack will not result in a significant impact on ambient air quality in the vicinity of the facility.

Appendix 9-2

Appendix 9-2

Mineral DRA Methodology

Patrick McCaffrey & Sons Ltd

Ballymagroarty Quarries, Ballintra, Co Donegal, Ireland

Contents

1 DISAMENTIY DUST RISK ASSESSMENT METHODOLOGY 1

1.1 Identification of Sensitive Receptors 1

1.2 Determining the Residual Source of Emissions 1

1.3 Estimation of the Pathway Effectiveness 4

1.4 Estimation of the Dust Impact Risk and Effects 5

2 REFERENCES 6

FIGURES

Figure 1-1: Site Preparation / Restoration 2

Figure 1-2: Mineral Extraction 2

Figure 1-3: Materials Handling 2

Figure 1-4: Onsite Transportation 3

Figure 1-5: Mineral Processing 3

Figure 1-6: Stockpiles / Exposed Surfaces 3

Figure 1-7: Offsite Transportation 4

TABLES

Table 1-1: Categorisation of Frequency of Potential Dust Winds 4

Table 1-2: Categorisation of Receptor Distance from Source 4

Table 1-3: Classification of the Pathway Effectiveness 5

Table 1-4: Estimation of Dust Impact Risks 5

Table 1-5: Descriptors for magnitude of Dust Effects 5

1 DISAMENTIY DUST RISK ASSESSMENT METHODOLOGY

The IAQM Guidance aims to provide advice on robust and consistent good-practice approaches that can be used to assess the operational phase dust impacts from quarry activities. [1]

1.1 Identification of Sensitive Receptors

For the sensitivity of people and their property to dust soiling, the IAQM recommends the use of professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies. The following classification was used to define a receptor with High, Medium or Low sensitivity to dust soiling:

High Sensitive Receptor

- Users can reasonably expect enjoyment of a high level of amenity;
- The appearance, aesthetics or value of their property would be diminished by soiling; and,
- The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.

Indicative examples of a high-sensitivity receptor included dwellings, medium- and long-term carparks and car showrooms.

Medium Sensitive Receptor:

- Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home;
- The appearance, aesthetics or value of their property could be diminished by soiling; and,
- The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.

Indicative examples include parks and places of work.

Low Sensitivity Receptor

- The enjoyment of amenity would not reasonably be expected;
- There is a property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; and,
- There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.

Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short-term car parks and roads.

1.2 Determining the Residual Source of Emissions

The following examples show the residual source emissions for a number of activities, illustrating the factors that may be considered when determining the potential impact.

Figure 1-1: Site Preparation / Restoration

An example of a large potential dust magnitude from site preparation/restoration may include factors such as a working area >10ha, bunds >8 m in height, >100,000 m^3 material movement, >10 heavy plant simultaneously active, bunds un-seeded, fine grained and friable material. Conversely, a small potential dust magnitude may include a site with a working area <2.5ha, bunds <4m in height, <20,000 m^3 material movement, <5 heavy plant simultaneously active, all bunds seeded, material with a high moisture content.

Figure 1-2: Mineral Extraction

An example of a large potential dust magnitude from mineral extraction may include a working area >100 ha, drilling and blasting frequently used, dusty mineral of small particle size and/or low moisture content, 1,000,000 tpa extraction rate. A small potential magnitude may include working area <20 ha, hydraulic excavator, coarse material and/or high moisture content, <200,000 tpa extraction rate.

Figure 1-3: Materials Handling

An example of a large potential dust magnitude from materials handling may include factors such as >10 loading plant within 50m of a site boundary, transferring material of a high dust potential and/or low moisture content on dry, poorly surfaced ground. Conversely, a small potential dust magnitude may include <5 plant, more than 100 m of a site boundary, within the quarry void or clean hardstanding, transferring material of low dust potential and/or high moisture content.

Figure 1-4: Onsite Transportation

An example of a large potential dust magnitude from on-site transportation could include >250 movements in any one day on unpaved surfaces of potentially dusty material. A small potential magnitude may include the employment of covered conveyors used for the majority of the on-site transportation of material, <100 movements of vehicles per day, with surface materials of compacted aggregate, <500 m in length and a maximum speed of 15 mph.

Figure 1-5: Mineral Processing

An example of a large potential dust magnitude from mineral processing may include factors such as a mobile crusher and screener with a concrete batching plant on-site, processing >1,000,000 tpa of material with a high dust potential and/or low moisture content e.g. hard rock. Conversely, a small potential dust magnitude may include a site with a fixed screening plant with effective design in dust control, processing <200,000 tpa of material with a low dust potential and/or high moisture content e.g. wet sand and gravel.

Figure 1-6: Stockpiles / Exposed Surfaces

An example of a large potential dust magnitude from stockpiles and exposed surfaces could include a stockpile with a total exposed area >10 ha in an area exposed to high wind speeds located <50 m of the site boundary. Daily transfer of material with a high dust potential and/or low moisture content. Stockpile duration >12 months and quarry production >1,000,000 tpa. A small potential magnitude may include stockpile duration of <1 month with a total area <2.5 ha in an area of low wind speeds, located >100 m from the site boundary. Weekly transfers of material with a low dust potential and/or high moisture content. Quarry production <200,000 tpa.

Figure 1-7: Offsite Transportation

An example of a large potential dust magnitude from off-site transportation could include total HDV >200 movements in any one day on an unsurfaced site access road <20 m in length with no HDV cleaning facilities. No road sweeper is available. A small potential magnitude may include <25 HDV movements per day, a paved surfaced site access road >50 m in length, with effective HDV cleaning facilities and procedures, and the employment of an effective road sweeper.

1.3 Estimation of the Pathway Effectiveness

The site-specific factors considered to determine the Effectiveness of the Pathway were the distance and direction of receptors relative to prevailing wind directions. Receptors were identified within 400m of the dust emission source. Table 1-1 shows the categorisation of the frequency of potential dust winds based on the meteorological data from a nearby weather station.

Table 1-1: Categorisation of Frequency of Potential Dust Winds

Frequency Category	Criteria
Infrequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are less than 5%
Moderately Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 5% and 12%
Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 12% and 20%
Very Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are greater than 20%

Table 1-2 below shows the categorisation of receptors, based on their distance to the dust emission source.

Table 1-2: Categorisation of Receptor Distance from Source

Distance Category	Criteria
Distant	Receptor is between 200m and 400m from the dust source
Intermediate	Receptor is between 100m and 200m from the dust source
Close	Receptor is less than 100m from the dust source

Table 1-3 below shows the determination of the Pathway Effectiveness based on the frequency of potentially dusty winds and the distance of the receptor from the dust emission source.

Table 1-3: Classification of the Pathway Effectiveness

Receptor Distance Category	Frequency of Potentially Dusty Winds			
	Infrequent	**Moderately Frequent**	**Frequent**	**Very Frequent**
Close	Ineffective	Moderately Effective	Highly Effective	Highly Effective
Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

1.4 Estimation of the Dust Impact Risk and Effects

Table 1-4 shows the estimation of the Dust Impact Risk based on the Residual Source of Emission and Pathway Effectiveness classifications.

Table 1-4: Estimation of Dust Impact Risks

Pathway Effectiveness	Residual Source Emission		
	Small	**Medium**	**Large**
Highly Effective Pathway	Low Risk	Medium Risk	High Risk
Moderate Effective Pathway	Negligible Risk	Low Risk	Medium Risk
Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

Table 1-5 below shows the estimate of the likely magnitude of Disamenity Effects based on the receptor sensitivity and the risk of dust impacts.

Table 1-5: Descriptors for magnitude of Dust Effects

Receptor Distance Category	Receptor Sensitivity		
	Low	**Medium**	**High**
High Risk	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium Risk	Negligible effect	Slight Adverse Effect	Moderate Adverse Effect
Low Risk	Negligible effect	Negligible effect	Slight Adverse Effect
Negligible Risk	Negligible effect	Negligible effect	Negligible effect

2 REFERENCES

[1] IAQM, “Guidance on the Assessment of Mineral Dust Impacts for Planning,” Institute of Air Quality Management, London, 2016.

Appendix 9-3

Month	Year	Test	Result	Units	Monitoring Location
1	2022	Settleable Dust (Bergerhoff Method)	135	mg/sq.m/Day	DS1
1	2022	Settleable Dust (Bergerhoff Method)	146	mg/sq.m/Day	DS2
1	2022	Settleable Dust (Bergerhoff Method)	94	mg/sq.m/Day	DS3
1	2022	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS4
1	2022	Settleable Dust (Bergerhoff Method)	239	mg/sq.m/Day	DS5
2	2022	Settleable Dust (Bergerhoff Method)	266	mg/sq.m/Day	DS1
2	2022	Settleable Dust (Bergerhoff Method)	404	mg/sq.m/Day	DS2
2	2022	Settleable Dust (Bergerhoff Method)	481	mg/sq.m/Day	DS3
2	2022	Settleable Dust (Bergerhoff Method)	551	mg/sq.m/Day	DS4
2	2022	Settleable Dust (Bergerhoff Method)	523	mg/sq.m/Day	DS5
3	2022	Settleable Dust (Bergerhoff Method)	531	mg/sq.m/Day	DS1
3	2022	Settleable Dust (Bergerhoff Method)	266	mg/sq.m/Day	DS2
3	2022	Settleable Dust (Bergerhoff Method)	364	mg/sq.m/Day	DS3
3	2022	Settleable Dust (Bergerhoff Method)	609	mg/sq.m/Day	DS4
3	2022	Settleable Dust (Bergerhoff Method)	896	mg/sq.m/Day	DS5
4	2022	Settleable Dust (Bergerhoff Method)	172	mg/sq.m/Day	DS1
4	2022	Settleable Dust (Bergerhoff Method)	134	mg/sq.m/Day	DS2
4	2022	Settleable Dust (Bergerhoff Method)	196	mg/sq.m/Day	DS3
4	2022	Settleable Dust (Bergerhoff Method)	127	mg/sq.m/Day	DS4
4	2022	Settleable Dust (Bergerhoff Method)	218	mg/sq.m/Day	DS5
5	2022	Settleable Dust (Bergerhoff Method)	70	mg/sq.m/Day	DS1
5	2022	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS2
5	2022	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS3
5	2022	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS4
5	2022	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS5
6	2022	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS1
6	2022	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS2
6	2022	Settleable Dust (Bergerhoff Method)	6	mg/sq.m/Day	DS3
6	2022	Settleable Dust (Bergerhoff Method)	6	mg/sq.m/Day	DS4
6	2022	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS5
7	2022	Settleable Dust (Bergerhoff Method)	54	mg/sq.m/Day	DS1
7	2022	Settleable Dust (Bergerhoff Method)	77	mg/sq.m/Day	DS2
7	2022	Settleable Dust (Bergerhoff Method)	116	mg/sq.m/Day	DS3
7	2022	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS4
7	2022	Settleable Dust (Bergerhoff Method)	396	mg/sq.m/Day	DS5
8	2022	Settleable Dust (Bergerhoff Method)	184	mg/sq.m/Day	DS1
8	2022	Settleable Dust (Bergerhoff Method)	189	mg/sq.m/Day	DS2
8	2022	Settleable Dust (Bergerhoff Method)	691	mg/sq.m/Day	DS3
8	2022	Settleable Dust (Bergerhoff Method)	280	mg/sq.m/Day	DS4
8	2022	Settleable Dust (Bergerhoff Method)	766	mg/sq.m/Day	DS5
9	2022	Settleable Dust (Bergerhoff Method)	187	mg/sq.m/Day	DS1
9	2022	Settleable Dust (Bergerhoff Method)	182	mg/sq.m/Day	DS2
9	2022	Settleable Dust (Bergerhoff Method)	204	mg/sq.m/Day	DS3
9	2022	Settleable Dust (Bergerhoff Method)	211	mg/sq.m/Day	DS4
9	2022	Settleable Dust (Bergerhoff Method)	222	mg/sq.m/Day	DS5
10	2022	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS1
10	2022	Settleable Dust (Bergerhoff Method)	246	mg/sq.m/Day	DS2
10	2022	Settleable Dust (Bergerhoff Method)	179	mg/sq.m/Day	DS3
10	2022	Settleable Dust (Bergerhoff Method)	116	mg/sq.m/Day	DS4
10	2022	Settleable Dust (Bergerhoff Method)	226	mg/sq.m/Day	DS5
11	2022	Settleable Dust (Bergerhoff Method)	42	mg/sq.m/Day	DS1

11	2022	Settleable Dust (Bergerhoff Method)	Jar Broken	mg/sq.m/Day	DS2
11	2022	Settleable Dust (Bergerhoff Method)	Jar Broken	mg/sq.m/Day	DS3
11	2022	Settleable Dust (Bergerhoff Method)	Jar Broken	mg/sq.m/Day	DS4
11	2022	Settleable Dust (Bergerhoff Method)	Jar Broken	mg/sq.m/Day	DS5
1	2021	Settleable Dust (Bergerhoff Method)	Broken Jar	mg/sq.m/Day	DS1
1	2021	Settleable Dust (Bergerhoff Method)	12	mg/sq.m/Day	DS2
1	2021	Settleable Dust (Bergerhoff Method)	19	mg/sq.m/Day	DS3
1	2021	Settleable Dust (Bergerhoff Method)	21	mg/sq.m/Day	DS4
1	2021	Settleable Dust (Bergerhoff Method)	5	mg/sq.m/Day	DS5
2	2021	Settleable Dust (Bergerhoff Method)	204	mg/sq.m/Day	DS1
2	2021	Settleable Dust (Bergerhoff Method)	113	mg/sq.m/Day	DS2
2	2021	Settleable Dust (Bergerhoff Method)	214	mg/sq.m/Day	DS3
2	2021	Settleable Dust (Bergerhoff Method)	141	mg/sq.m/Day	DS4
2	2021	Settleable Dust (Bergerhoff Method)	177	mg/sq.m/Day	DS5
3	2021	Settleable Dust (Bergerhoff Method)	167	mg/sq.m/Day	DS1
3	2021	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS2
3	2021	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS3
3	2021	Settleable Dust (Bergerhoff Method)	46	mg/sq.m/Day	DS4
3	2021	Settleable Dust (Bergerhoff Method)	90	mg/sq.m/Day	DS5
4	2021	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS1
4	2021	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS2
4	2021	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS3
4	2021	Settleable Dust (Bergerhoff Method)	28	mg/sq.m/Day	DS4
4	2021	Settleable Dust (Bergerhoff Method)	73	mg/sq.m/Day	DS5
5	2021	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS1
5	2021	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS2
5	2021	Settleable Dust (Bergerhoff Method)	42	mg/sq.m/Day	DS3
5	2021	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
5	2021	Settleable Dust (Bergerhoff Method)	127	mg/sq.m/Day	DS5
6	2021	Settleable Dust (Bergerhoff Method)	29	mg/sq.m/Day	DS1
6	2021	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS2
6	2021	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS3
6	2021	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS4
6	2021	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS5
7	2021	Settleable Dust (Bergerhoff Method)	265	mg/sq.m/Day	DS1
7	2021	Settleable Dust (Bergerhoff Method)	177	mg/sq.m/Day	DS2
7	2021	Settleable Dust (Bergerhoff Method)	147	mg/sq.m/Day	DS3
7	2021	Settleable Dust (Bergerhoff Method)	156	mg/sq.m/Day	DS4
7	2021	Settleable Dust (Bergerhoff Method)	238	mg/sq.m/Day	DS5
8	2021	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS1
8	2021	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS2
8	2021	Settleable Dust (Bergerhoff Method)	62	mg/sq.m/Day	DS3
8	2021	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS4
8	2021	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS5
9	2021	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS1
9	2021	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS2
9	2021	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS3
9	2021	Settleable Dust (Bergerhoff Method)	93	mg/sq.m/Day	DS4
9	2021	Settleable Dust (Bergerhoff Method)	97	mg/sq.m/Day	DS5
10	2021	Settleable Dust (Bergerhoff Method)	87	mg/sq.m/Day	DS1
10	2021	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS2
10	2021	Settleable Dust (Bergerhoff Method)	132	mg/sq.m/Day	DS3

10	2021	Settleable Dust (Bergerhoff Method)	108	mg/sq.m/Day	DS4
10	2021	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS5
11	2021	Settleable Dust (Bergerhoff Method)	198	mg/sq.m/Day	DS1
11	2021	Settleable Dust (Bergerhoff Method)	185	mg/sq.m/Day	DS2
11	2021	Settleable Dust (Bergerhoff Method)	245	mg/sq.m/Day	DS3
11	2021	Settleable Dust (Bergerhoff Method)	221	mg/sq.m/Day	DS4
11	2021	Settleable Dust (Bergerhoff Method)	200	mg/sq.m/Day	DS5
12	2021	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS1
12	2021	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS2
12	2021	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS3
12	2021	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS4
12	2021	Settleable Dust (Bergerhoff Method)	71	mg/sq.m/Day	DS5
0.5	2020	Settleable Dust (Bergerhoff Method)	11	mg/sq.m/Day	DS1
0.5	2020	Settleable Dust (Bergerhoff Method)	88	mg/sq.m/Day	DS2
0.5	2020	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS3
0.5	2020	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS4
0.5	2020	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS5
1	2020	Settleable Dust (Bergerhoff Method)	21	mg/sq.m/Day	DS1
1	2020	Settleable Dust (Bergerhoff Method)	170	mg/sq.m/Day	DS2
1	2020	Settleable Dust (Bergerhoff Method)	90	mg/sq.m/Day	DS3
1	2020	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS4
1	2020	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS5
2	2020	Settleable Dust (Bergerhoff Method)	91	mg/sq.m/Day	DS1
2	2020	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS2
2	2020	Settleable Dust (Bergerhoff Method)	57	mg/sq.m/Day	DS3
2	2020	Settleable Dust (Bergerhoff Method)	100	mg/sq.m/Day	DS4
2	2020	Settleable Dust (Bergerhoff Method)	91	mg/sq.m/Day	DS5
3.5	2020	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS1
3.5	2020	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS2
3.5	2020	Settleable Dust (Bergerhoff Method)	198	mg/sq.m/Day	DS3
3.5	2020	Settleable Dust (Bergerhoff Method)	12	mg/sq.m/Day	DS4
3.5	2020	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS5
5	2020	Settleable Dust (Bergerhoff Method)	545	mg/sq.m/Day	DS1
5	2020	Settleable Dust (Bergerhoff Method)	519	mg/sq.m/Day	DS2
5	2020	Settleable Dust (Bergerhoff Method)	546	mg/sq.m/Day	DS3
5	2020	Settleable Dust (Bergerhoff Method)	492	mg/sq.m/Day	DS4
5	2020	Settleable Dust (Bergerhoff Method)	619	mg/sq.m/Day	DS5
6	2020	Settleable Dust (Bergerhoff Method)	78	mg/sq.m/Day	DS1
6	2020	Settleable Dust (Bergerhoff Method)	Jar missiing	mg/sq.m/Day	DS2
6	2020	Settleable Dust (Bergerhoff Method)	57	mg/sq.m/Day	DS3
6	2020	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS4
6	2020	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS5
7	2020	Settleable Dust (Bergerhoff Method)	42	mg/sq.m/Day	DS1
7	2020	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS2
7	2020	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS3
7	2020	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS4
7	2020	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS5
8	2020	Settleable Dust (Bergerhoff Method)	274	mg/sq.m/Day	DS1
8	2020	Settleable Dust (Bergerhoff Method)	95	mg/sq.m/Day	DS2
8	2020	Settleable Dust (Bergerhoff Method)	249	mg/sq.m/Day	DS3
8	2020	Settleable Dust (Bergerhoff Method)	76	mg/sq.m/Day	DS4
8	2020	Settleable Dust (Bergerhoff Method)	115	mg/sq.m/Day	DS5

9	2020	Settleable Dust (Bergerhoff Method)	67	mg/sq.m/Day	DS1
9	2020	Settleable Dust (Bergerhoff Method)	60	mg/sq.m/Day	DS2
9	2020	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS3
9	2020	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS4
9	2020	Settleable Dust (Bergerhoff Method)	675	mg/sq.m/Day	DS5
10	2020	Settleable Dust (Bergerhoff Method)	90	mg/sq.m/Day	DS1
10	2020	Settleable Dust (Bergerhoff Method)	108	mg/sq.m/Day	DS2
10	2020	Settleable Dust (Bergerhoff Method)	125	mg/sq.m/Day	DS3
10	2020	Settleable Dust (Bergerhoff Method)	559	mg/sq.m/Day	DS4
10	2020	Settleable Dust (Bergerhoff Method)	185	mg/sq.m/Day	DS5
11	2020	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS1
11	2020	Settleable Dust (Bergerhoff Method)	19	mg/sq.m/Day	DS2
11	2020	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS3
11	2020	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS4
11	2020	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS5
12	2020	Settleable Dust (Bergerhoff Method)	166	mg/sq.m/Day	DS1
12	2020	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS2
12	2020	Settleable Dust (Bergerhoff Method)	86	mg/sq.m/Day	DS3
12	2020	Settleable Dust (Bergerhoff Method)	71	mg/sq.m/Day	DS4
12	2020	Settleable Dust (Bergerhoff Method)	120	mg/sq.m/Day	DS5
1	2019	Settleable Dust (Bergerhoff Method)	96	mg/sq.m/Day	DS1
1	2019	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS2
1	2019	Settleable Dust (Bergerhoff Method)	56	mg/sq.m/Day	DS3
1	2019	Settleable Dust (Bergerhoff Method)	70	mg/sq.m/Day	DS4
1	2019	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS5
2	2019	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS1
2	2019	Settleable Dust (Bergerhoff Method)	144	mg/sq.m/Day	DS2
2	2019	Settleable Dust (Bergerhoff Method)	144	mg/sq.m/Day	DS3
2	2019	Settleable Dust (Bergerhoff Method)	112	mg/sq.m/Day	DS4
2	2019	Settleable Dust (Bergerhoff Method)	188	mg/sq.m/Day	DS5
3	2019	Settleable Dust (Bergerhoff Method)	87	mg/sq.m/Day	DS1
3	2019	Settleable Dust (Bergerhoff Method)	84	mg/sq.m/Day	DS2
3	2019	Settleable Dust (Bergerhoff Method)	187	mg/sq.m/Day	DS3
3	2019	Settleable Dust (Bergerhoff Method)	134	mg/sq.m/Day	DS4
3	2019	Settleable Dust (Bergerhoff Method)	83	mg/sq.m/Day	DS5
4	2019	Settleable Dust (Bergerhoff Method)	165	mg/sq.m/Day	DS1
4	2019	Settleable Dust (Bergerhoff Method)	173	mg/sq.m/Day	DS2
4	2019	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS3
4	2019	Settleable Dust (Bergerhoff Method)	211	mg/sq.m/Day	DS4
4	2019	Settleable Dust (Bergerhoff Method)	172	mg/sq.m/Day	DS5
5	2019	Settleable Dust (Bergerhoff Method)	232	mg/sq.m/Day	DS1
5	2019	Settleable Dust (Bergerhoff Method)	278	mg/sq.m/Day	DS2
5	2019	Settleable Dust (Bergerhoff Method)	769	mg/sq.m/Day	DS3
5	2019	Settleable Dust (Bergerhoff Method)	1076	mg/sq.m/Day	DS4
5	2019	Settleable Dust (Bergerhoff Method)	744	mg/sq.m/Day	DS5
6	2019	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS1
6	2019	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS2
6	2019	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS3
6	2019	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
6	2019	Settleable Dust (Bergerhoff Method)	74	mg/sq.m/Day	DS5
7	2019	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS1
7	2019	Settleable Dust (Bergerhoff Method)	52	mg/sq.m/Day	DS2

7	2019	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS3
7	2019	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
7	2019	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS5
8	2019	Settleable Dust (Bergerhoff Method)	370	mg/sq.m/Day	DS1
8	2019	Settleable Dust (Bergerhoff Method)	532	mg/sq.m/Day	DS2
8	2019	Settleable Dust (Bergerhoff Method)	469	mg/sq.m/Day	DS3
8	2019	Settleable Dust (Bergerhoff Method)	430	mg/sq.m/Day	DS4
8	2019	Settleable Dust (Bergerhoff Method)	316	mg/sq.m/Day	DS5
9	2019	Settleable Dust (Bergerhoff Method)	51	mg/sq.m/Day	DS1
9	2019	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS2
9	2019	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS3
9	2019	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS4
9	2019	Settleable Dust (Bergerhoff Method)	77	mg/sq.m/Day	DS5
10	2019	Settleable Dust (Bergerhoff Method)	123	mg/sq.m/Day	DS1
10	2019	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS2
10	2019	Settleable Dust (Bergerhoff Method)	169	mg/sq.m/Day	DS3
10	2019	Settleable Dust (Bergerhoff Method)	125	mg/sq.m/Day	DS4
10	2019	Settleable Dust (Bergerhoff Method)	119	mg/sq.m/Day	DS5
11	2019	Settleable Dust (Bergerhoff Method)	117	mg/sq.m/Day	DS1
11	2019	Settleable Dust (Bergerhoff Method)	112	mg/sq.m/Day	DS2
11	2019	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS3
11	2019	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS4
11	2019	Settleable Dust (Bergerhoff Method)	124	mg/sq.m/Day	DS5
12	2019	Settleable Dust (Bergerhoff Method)	167	mg/sq.m/Day	DS1
12	2019	Settleable Dust (Bergerhoff Method)	180	mg/sq.m/Day	DS2
12	2019	Settleable Dust (Bergerhoff Method)	189	mg/sq.m/Day	DS3
12	2019	Settleable Dust (Bergerhoff Method)	211	mg/sq.m/Day	DS4
12	2019	Settleable Dust (Bergerhoff Method)	115	mg/sq.m/Day	DS5
1	2018	Settleable Dust (Bergerhoff Method)	285	mg/sq.m/Day	DS1
1	2018	Settleable Dust (Bergerhoff Method)	213	mg/sq.m/Day	DS2
1	2018	Settleable Dust (Bergerhoff Method)	281	mg/sq.m/Day	DS3
1	2018	Settleable Dust (Bergerhoff Method)	313	mg/sq.m/Day	DS4
1	2018	Settleable Dust (Bergerhoff Method)	290	mg/sq.m/Day	DS5
2	2018	Settleable Dust (Bergerhoff Method)	674	mg/sq.m/Day	DS1
2	2018	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS2
2	2018	Settleable Dust (Bergerhoff Method)	106	mg/sq.m/Day	DS3
2	2018	Settleable Dust (Bergerhoff Method)	95	mg/sq.m/Day	DS4
2	2018	Settleable Dust (Bergerhoff Method)	194	mg/sq.m/Day	DS5
3	2018	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS1
3	2018	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS2
3	2018	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS3
3	2018	Settleable Dust (Bergerhoff Method)	50	mg/sq.m/Day	DS4
3	2018	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS5
4	2018	Settleable Dust (Bergerhoff Method)	170	mg/sq.m/Day	DS1
4	2018	Settleable Dust (Bergerhoff Method)	162	mg/sq.m/Day	DS2
4	2018	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS3
4	2018	Settleable Dust (Bergerhoff Method)	104	mg/sq.m/Day	DS4
4	2018	Settleable Dust (Bergerhoff Method)	119	mg/sq.m/Day	DS5
5	2018	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS1
5	2018	Settleable Dust (Bergerhoff Method)	87	mg/sq.m/Day	DS2
5	2018	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS3
5	2018	Settleable Dust (Bergerhoff Method)	81	mg/sq.m/Day	DS4

5	2018	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS5
6	2018	Settleable Dust (Bergerhoff Method)	129	mg/sq.m/Day	DS1
6	2018	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS2
6	2018	Settleable Dust (Bergerhoff Method)	400	mg/sq.m/Day	DS3
6	2018	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS4
6	2018	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS5
7	2018	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS1
7	2018	Settleable Dust (Bergerhoff Method)	166	mg/sq.m/Day	DS2
7	2018	Settleable Dust (Bergerhoff Method)	46	mg/sq.m/Day	DS3
7	2018	Settleable Dust (Bergerhoff Method)	195	mg/sq.m/Day	DS4
7	2018	Settleable Dust (Bergerhoff Method)	57	mg/sq.m/Day	DS5
8	2018	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS1
8	2018	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS2
8	2018	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS3
8	2018	Settleable Dust (Bergerhoff Method)	114	mg/sq.m/Day	DS4
8	2018	Settleable Dust (Bergerhoff Method)	158	mg/sq.m/Day	DS5
9	2018	Settleable Dust (Bergerhoff Method)	125	mg/sq.m/Day	DS1
9	2018	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS2
9	2018	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS3
9	2018	Settleable Dust (Bergerhoff Method)	76	mg/sq.m/Day	DS4
9	2018	Settleable Dust (Bergerhoff Method)	170	mg/sq.m/Day	DS5
10	2018	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS1
10	2018	Settleable Dust (Bergerhoff Method)	176	mg/sq.m/Day	DS2
10	2018	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS3
10	2018	Settleable Dust (Bergerhoff Method)	86	mg/sq.m/Day	DS4
10	2018	Settleable Dust (Bergerhoff Method)	257	mg/sq.m/Day	DS5
11	2018	Settleable Dust (Bergerhoff Method)	357	mg/sq.m/Day	DS1
11	2018	Settleable Dust (Bergerhoff Method)	411	mg/sq.m/Day	DS2
11	2018	Settleable Dust (Bergerhoff Method)	305	mg/sq.m/Day	DS3
11	2018	Settleable Dust (Bergerhoff Method)	327	mg/sq.m/Day	DS4
11	2018	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS5
12	2018	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS1
12	2018	Settleable Dust (Bergerhoff Method)	65	mg/sq.m/Day	DS2
12	2018	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS3
12	2018	Settleable Dust (Bergerhoff Method)	46	mg/sq.m/Day	DS4
12	2018	Settleable Dust (Bergerhoff Method)	55	mg/sq.m/Day	DS5
1	2017	Settleable Dust (Bergerhoff Method)	166	mg/sq.m/Day	DS1
1	2017	Settleable Dust (Bergerhoff Method)	114	mg/sq.m/Day	DS2
1	2017	Settleable Dust (Bergerhoff Method)	153	mg/sq.m/Day	DS3
1	2017	Settleable Dust (Bergerhoff Method)	145	mg/sq.m/Day	DS4
1	2017	Settleable Dust (Bergerhoff Method)	71	mg/sq.m/Day	DS5
2	2017	Settleable Dust (Bergerhoff Method)	270	mg/sq.m/Day	DS1
2	2017	Settleable Dust (Bergerhoff Method)	221	mg/sq.m/Day	DS2
2	2017	Settleable Dust (Bergerhoff Method)	97	mg/sq.m/Day	DS3
2	2017	Settleable Dust (Bergerhoff Method)	298	mg/sq.m/Day	DS4
2	2017	Settleable Dust (Bergerhoff Method)	88	mg/sq.m/Day	DS5
3	2017	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS1
3	2017	Settleable Dust (Bergerhoff Method)	5	mg/sq.m/Day	DS2
3	2017	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS3
3	2017	Settleable Dust (Bergerhoff Method)	77	mg/sq.m/Day	DS4
3	2017	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS5
4	2017	Settleable Dust (Bergerhoff Method)	137	mg/sq.m/Day	DS1

4	2017	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS2
4	2017	Settleable Dust (Bergerhoff Method)	101	mg/sq.m/Day	DS3
4	2017	Settleable Dust (Bergerhoff Method)	176	mg/sq.m/Day	DS4
4	2017	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS5
5	2017	Settleable Dust (Bergerhoff Method)	78	mg/sq.m/Day	DS1
5	2017	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS2
5	2017	Settleable Dust (Bergerhoff Method)	37	mg/sq.m/Day	DS3
5	2017	Settleable Dust (Bergerhoff Method)	30	mg/sq.m/Day	DS4
5	2017	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS5
6	2017	Settleable Dust (Bergerhoff Method)	310	mg/sq.m/Day	DS1
6	2017	Settleable Dust (Bergerhoff Method)	251	mg/sq.m/Day	DS2
6	2017	Settleable Dust (Bergerhoff Method)	495	mg/sq.m/Day	DS3
6	2017	Settleable Dust (Bergerhoff Method)	424	mg/sq.m/Day	DS4
6	2017	Settleable Dust (Bergerhoff Method)	234	mg/sq.m/Day	DS5
7	2017	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS1
7	2017	Settleable Dust (Bergerhoff Method)	7	mg/sq.m/Day	DS2
7	2017	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS3
7	2017	Settleable Dust (Bergerhoff Method)	117	mg/sq.m/Day	DS4
7	2017	Settleable Dust (Bergerhoff Method)	52	mg/sq.m/Day	DS5
8	2017	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS1
8	2017	Settleable Dust (Bergerhoff Method)	111	mg/sq.m/Day	DS2
8	2017	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS3
8	2017	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS4
8	2017	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS5
9	2017	Settleable Dust (Bergerhoff Method)	393	mg/sq.m/Day	DS1
9	2017	Settleable Dust (Bergerhoff Method)	192	mg/sq.m/Day	DS2
9	2017	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS3
9	2017	Settleable Dust (Bergerhoff Method)	379	mg/sq.m/Day	DS4
9	2017	Settleable Dust (Bergerhoff Method)	100	mg/sq.m/Day	DS5
10	2017	Settleable Dust (Bergerhoff Method)	11	mg/sq.m/Day	DS1
10	2017	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS2
10	2017	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS3
10	2017	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS4
10	2017	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS5
11	2017	Settleable Dust (Bergerhoff Method)	77	mg/sq.m/Day	DS1
11	2017	Settleable Dust (Bergerhoff Method)	82	mg/sq.m/Day	DS2
11	2017	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS3
11	2017	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS4
11	2017	Settleable Dust (Bergerhoff Method)	54	mg/sq.m/Day	DS5
12	2017	Settleable Dust (Bergerhoff Method)	190	mg/sq.m/Day	DS1
12	2017	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS2
12	2017	Settleable Dust (Bergerhoff Method)	211	mg/sq.m/Day	DS3
12	2017	Settleable Dust (Bergerhoff Method)	157	mg/sq.m/Day	DS4
12	2017	Settleable Dust (Bergerhoff Method)	106	mg/sq.m/Day	DS5
1	2016	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS1
1	2016	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS2
1	2016	Settleable Dust (Bergerhoff Method)	51	mg/sq.m/Day	DS3
1	2016	Settleable Dust (Bergerhoff Method)	62	mg/sq.m/Day	DS4
1	2016	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS5
2	2016	Settleable Dust (Bergerhoff Method)	563	mg/sq.m/Day	DS1
2	2016	Settleable Dust (Bergerhoff Method)	817	mg/sq.m/Day	DS2
2	2016	Settleable Dust (Bergerhoff Method)	636	mg/sq.m/Day	DS3

2	2016	Settleable Dust (Bergerhoff Method)	678	mg/sq.m/Day	DS4
2	2016	Settleable Dust (Bergerhoff Method)	469	mg/sq.m/Day	DS5
3	2016	Settleable Dust (Bergerhoff Method)	140	mg/sq.m/Day	DS1
3	2016	Settleable Dust (Bergerhoff Method)	138	mg/sq.m/Day	DS2
3	2016	Settleable Dust (Bergerhoff Method)	148	mg/sq.m/Day	DS3
3	2016	Settleable Dust (Bergerhoff Method)	137	mg/sq.m/Day	DS4
3	2016	Settleable Dust (Bergerhoff Method)	144	mg/sq.m/Day	DS5
4	2016	Settleable Dust (Bergerhoff Method)	81	mg/sq.m/Day	DS1
4	2016	Settleable Dust (Bergerhoff Method)	55	mg/sq.m/Day	DS2
4	2016	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS3
4	2016	Settleable Dust (Bergerhoff Method)	65	mg/sq.m/Day	DS4
4	2016	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS5
5	2016	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS1
5	2016	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS2
5	2016	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS3
5	2016	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
5	2016	Settleable Dust (Bergerhoff Method)	9	mg/sq.m/Day	DS5
6	2016	Settleable Dust (Bergerhoff Method)	320	mg/sq.m/Day	DS1
6	2016	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS2
6	2016	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS3
6	2016	Settleable Dust (Bergerhoff Method)	117	mg/sq.m/Day	DS4
6	2016	Settleable Dust (Bergerhoff Method)	99	mg/sq.m/Day	DS5
7	2016	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS1
7	2016	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS2
7	2016	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS3
7	2016	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS4
7	2016	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS5
8	2016	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS1
8	2016	Settleable Dust (Bergerhoff Method)	9	mg/sq.m/Day	DS2
8	2016	Settleable Dust (Bergerhoff Method)	100	mg/sq.m/Day	DS3
8	2016	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS4
8	2016	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS5
9	2016	Settleable Dust (Bergerhoff Method)	115	mg/sq.m/Day	DS1
9	2016	Settleable Dust (Bergerhoff Method)	17	mg/sq.m/Day	DS2
9	2016	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS3
9	2016	Settleable Dust (Bergerhoff Method)	42	mg/sq.m/Day	DS4
9	2016	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS5
10	2016	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS1
10	2016	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS2
10	2016	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS3
10	2016	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS4
10	2016	Settleable Dust (Bergerhoff Method)	95	mg/sq.m/Day	DS5
11	2016	Settleable Dust (Bergerhoff Method)	90	mg/sq.m/Day	DS1
11	2016	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS2
11	2016	Settleable Dust (Bergerhoff Method)	70	mg/sq.m/Day	DS3
11	2016	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS4
11	2016	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS5
1	2015	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS1
1	2015	Settleable Dust (Bergerhoff Method)	136	mg/sq.m/Day	DS2
1	2015	Settleable Dust (Bergerhoff Method)	119	mg/sq.m/Day	DS3
1	2015	Settleable Dust (Bergerhoff Method)	Broken Jar	mg/sq.m/Day	DS4
1	2015	Settleable Dust (Bergerhoff Method)	144	mg/sq.m/Day	DS5
2	2015	Settleable Dust (Bergerhoff Method)	146	mg/sq.m/Day	DS1

2	2015	Settleable Dust (Bergerhoff Method)	91	mg/sq.m/Day	DS2
2	2015	Settleable Dust (Bergerhoff Method)	123	mg/sq.m/Day	DS3
2	2015	Settleable Dust (Bergerhoff Method)	120	mg/sq.m/Day	DS4
2	2015	Settleable Dust (Bergerhoff Method)	139	mg/sq.m/Day	DS5
3	2015	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS1
3	2015	Settleable Dust (Bergerhoff Method)	102	mg/sq.m/Day	DS2
3	2015	Settleable Dust (Bergerhoff Method)	94	mg/sq.m/Day	DS3
3	2015	Settleable Dust (Bergerhoff Method)	96	mg/sq.m/Day	DS4
3	2015	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS5
4	2015	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS1
4	2015	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS2
4	2015	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS3
4	2015	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS4
4	2015	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS5
5	2015	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS1
5	2015	Settleable Dust (Bergerhoff Method)	30	mg/sq.m/Day	DS2
5	2015	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS3
5	2015	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS4
5	2015	Settleable Dust (Bergerhoff Method)	55	mg/sq.m/Day	DS5
6	2015	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS1
6	2015	Settleable Dust (Bergerhoff Method)	108	mg/sq.m/Day	DS2
6	2015	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS3
6	2015	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS4
6	2015	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS5
7	2015	Settleable Dust (Bergerhoff Method)	123	mg/sq.m/Day	DS1
7	2015	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS2
7	2015	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS3
7	2015	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS4
7	2015	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS5
8	2015	Settleable Dust (Bergerhoff Method)	57	mg/sq.m/Day	DS1
8	2015	Settleable Dust (Bergerhoff Method)	67	mg/sq.m/Day	DS2
8	2015	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS3
8	2015	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
8	2015	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS5
9	2015	Settleable Dust (Bergerhoff Method)	55	mg/sq.m/Day	DS1
9	2015	Settleable Dust (Bergerhoff Method)	104	mg/sq.m/Day	DS2
9	2015	Settleable Dust (Bergerhoff Method)	112	mg/sq.m/Day	DS3
9	2015	Settleable Dust (Bergerhoff Method)	84	mg/sq.m/Day	DS4
9	2015	Settleable Dust (Bergerhoff Method)	29	mg/sq.m/Day	DS5
10	2015	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS1
10	2015	Settleable Dust (Bergerhoff Method)	49	mg/sq.m/Day	DS2
10	2015	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS3
10	2015	Settleable Dust (Bergerhoff Method)	37	mg/sq.m/Day	DS4
10	2015	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS5
11	2015	Settleable Dust (Bergerhoff Method)	93	mg/sq.m/Day	DS1
11	2015	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS2
11	2015	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS3
11	2015	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS4
11	2015	Settleable Dust (Bergerhoff Method)	5	mg/sq.m/Day	DS5
12	2015	Settleable Dust (Bergerhoff Method)	30	mg/sq.m/Day	DS1
12	2015	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS2
12	2015	Settleable Dust (Bergerhoff Method)	71	mg/sq.m/Day	DS3

12	2015	Settleable Dust (Bergerhoff Method)	60	mg/sq.m/Day	DS4
12	2015	Settleable Dust (Bergerhoff Method)	77	mg/sq.m/Day	DS5
1	2014	Settleable Dust (Bergerhoff Method)	95	mg/sq.m/Day	DS1
1	2014	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS2
1	2014	Settleable Dust (Bergerhoff Method)	124	mg/sq.m/Day	DS3
1	2014	Settleable Dust (Bergerhoff Method)	78	mg/sq.m/Day	DS4
1	2014	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS5
2	2014	Settleable Dust (Bergerhoff Method)	80	mg/sq.m/Day	DS1
2	2014	Settleable Dust (Bergerhoff Method)	132	mg/sq.m/Day	DS2
2	2014	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS3
2	2014	Settleable Dust (Bergerhoff Method)	97	mg/sq.m/Day	DS4
2	2014	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS5
3	2014	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS1
3	2014	Settleable Dust (Bergerhoff Method)	78	mg/sq.m/Day	DS2
3	2014	Settleable Dust (Bergerhoff Method)	18	mg/sq.m/Day	DS3
3	2014	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS4
3	2014	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS5
4	2014	Settleable Dust (Bergerhoff Method)	89	mg/sq.m/Day	DS1
4	2014	Settleable Dust (Bergerhoff Method)	76	mg/sq.m/Day	DS2
4	2014	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS3
4	2014	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS4
4	2014	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS5
5	2014	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS1
5	2014	Settleable Dust (Bergerhoff Method)	121	mg/sq.m/Day	DS2
5	2014	Settleable Dust (Bergerhoff Method)	98	mg/sq.m/Day	DS3
5	2014	Settleable Dust (Bergerhoff Method)	102	mg/sq.m/Day	DS4
5	2014	Settleable Dust (Bergerhoff Method)	43	mg/sq.m/Day	DS5
6	2014	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS1
6	2014	Settleable Dust (Bergerhoff Method)	20	mg/sq.m/Day	DS2
6	2014	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS3
6	2014	Settleable Dust (Bergerhoff Method)	73	mg/sq.m/Day	DS4
6	2014	Settleable Dust (Bergerhoff Method)	83	mg/sq.m/Day	DS5
7	2014	Settleable Dust (Bergerhoff Method)	83	mg/sq.m/Day	DS1
7	2014	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS2
7	2014	Settleable Dust (Bergerhoff Method)	81	mg/sq.m/Day	DS3
7	2014	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS4
7	2014	Settleable Dust (Bergerhoff Method)	74	mg/sq.m/Day	DS5
8	2014	Settleable Dust (Bergerhoff Method)	125	mg/sq.m/Day	DS1
8	2014	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS2
8	2014	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS3
8	2014	Settleable Dust (Bergerhoff Method)	80	mg/sq.m/Day	DS4
8	2014	Settleable Dust (Bergerhoff Method)	46	mg/sq.m/Day	DS5
9	2014	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS1
9	2014	Settleable Dust (Bergerhoff Method)	101	mg/sq.m/Day	DS2
9	2014	Settleable Dust (Bergerhoff Method)	40	mg/sq.m/Day	DS3
9	2014	Settleable Dust (Bergerhoff Method)	56	mg/sq.m/Day	DS4
9	2014	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS5
10	2014	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS1
10	2014	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS2
10	2014	Settleable Dust (Bergerhoff Method)	135	mg/sq.m/Day	DS3
10	2014	Settleable Dust (Bergerhoff Method)	126	mg/sq.m/Day	DS4

10	2014	Settleable Dust (Bergerhoff Method)	59	mg/sq.m/Day	DS5
11	2014	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS1
11	2014	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS2
11	2014	Settleable Dust (Bergerhoff Method)	99	mg/sq.m/Day	DS3
11	2014	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS4
11	2014	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS5
12	2014	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS1
12	2014	Settleable Dust (Bergerhoff Method)	102	mg/sq.m/Day	DS2
12	2014	Settleable Dust (Bergerhoff Method)	99	mg/sq.m/Day	DS3
12	2014	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS4
12	2014	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS5
1	2013	Settleable Dust (Bergerhoff Method)	62	mg/sq.m/Day	DS1
1	2013	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS2
1	2013	Settleable Dust (Bergerhoff Method)	82	mg/sq.m/Day	DS3
1	2013	Settleable Dust (Bergerhoff Method)	102	mg/sq.m/Day	DS4
1	2013	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS5
2	2013	Settleable Dust (Bergerhoff Method)	40	mg/sq.m/Day	DS1
2	2013	Settleable Dust (Bergerhoff Method)	28	mg/sq.m/Day	DS2
2	2013	Settleable Dust (Bergerhoff Method)	86	mg/sq.m/Day	DS3
2	2013	Settleable Dust (Bergerhoff Method)	50	mg/sq.m/Day	DS4
2	2013	Settleable Dust (Bergerhoff Method)	65	mg/sq.m/Day	DS5
3	2013	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS1
3	2013	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS2
3	2013	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS3
3	2013	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
3	2013	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS5
4	2013	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS1
4	2013	Settleable Dust (Bergerhoff Method)	54	mg/sq.m/Day	DS2
4	2013	Settleable Dust (Bergerhoff Method)	91	mg/sq.m/Day	DS3
4	2013	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS4
4	2013	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS5
5	2013	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS1
5	2013	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS2
5	2013	Settleable Dust (Bergerhoff Method)	21	mg/sq.m/Day	DS3
5	2013	Settleable Dust (Bergerhoff Method)	70	mg/sq.m/Day	DS4
5	2013	Settleable Dust (Bergerhoff Method)	76	mg/sq.m/Day	DS5
6	2013	Settleable Dust (Bergerhoff Method)	162	mg/sq.m/Day	DS1
6	2013	Settleable Dust (Bergerhoff Method)	111	mg/sq.m/Day	DS2
6	2013	Settleable Dust (Bergerhoff Method)	1339	mg/sq.m/Day	DS3
6	2013	Settleable Dust (Bergerhoff Method)	697	mg/sq.m/Day	DS4
6	2013	Settleable Dust (Bergerhoff Method)	74	mg/sq.m/Day	DS5
7	2013	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS1
7	2013	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS2
7	2013	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS3
7	2013	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS4
7	2013	Settleable Dust (Bergerhoff Method)	17	mg/sq.m/Day	DS5
8	2013	Settleable Dust (Bergerhoff Method)	112	mg/sq.m/Day	DS1
8	2013	Settleable Dust (Bergerhoff Method)	No Jar	mg/sq.m/Day	DS2
8	2013	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS3
8	2013	Settleable Dust (Bergerhoff Method)	93	mg/sq.m/Day	DS4
8	2013	Settleable Dust (Bergerhoff Method)	75	mg/sq.m/Day	DS5

9	2013	Settleable Dust (Bergerhoff Method)	60	mg/sq.m/Day	DS1
9	2013	Settleable Dust (Bergerhoff Method)	40	mg/sq.m/Day	DS2
9	2013	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS3
9	2013	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS4
9	2013	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS5
10	2013	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS1
10	2013	Settleable Dust (Bergerhoff Method)	20	mg/sq.m/Day	DS2
10	2013	Settleable Dust (Bergerhoff Method)	18	mg/sq.m/Day	DS3
10	2013	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS4
10	2013	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS5
11	2013	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS1
11	2013	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS2
11	2013	Settleable Dust (Bergerhoff Method)	29	mg/sq.m/Day	DS3
11	2013	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS4
11	2013	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS5
12	2013	Settleable Dust (Bergerhoff Method)	80	mg/sq.m/Day	DS1
12	2013	Settleable Dust (Bergerhoff Method)	114	mg/sq.m/Day	DS2
12	2013	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS3
12	2013	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS4
12	2013	Settleable Dust (Bergerhoff Method)	76	mg/sq.m/Day	DS5
1	2012	Settleable Dust (Bergerhoff Method)	148	mg/sq.m/Day	DS1
1	2012	Settleable Dust (Bergerhoff Method)	156	mg/sq.m/Day	DS2
1	2012	Settleable Dust (Bergerhoff Method)	141	mg/sq.m/Day	DS3
1	2012	Settleable Dust (Bergerhoff Method)	152	mg/sq.m/Day	DS4
1	2012	Settleable Dust (Bergerhoff Method)	143	mg/sq.m/Day	DS5
2	2012	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS1
2	2012	Settleable Dust (Bergerhoff Method)	80	mg/sq.m/Day	DS2
2	2012	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS3
2	2012	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS4
2	2012	Settleable Dust (Bergerhoff Method)	96	mg/sq.m/Day	DS5
3	2012	Settleable Dust (Bergerhoff Method)	20	mg/sq.m/Day	DS1
3	2012	Settleable Dust (Bergerhoff Method)	152	mg/sq.m/Day	DS2
3	2012	Settleable Dust (Bergerhoff Method)	116	mg/sq.m/Day	DS3
3	2012	Settleable Dust (Bergerhoff Method)	71	mg/sq.m/Day	DS4
3	2012	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS5
4	2012	Settleable Dust (Bergerhoff Method)	112	mg/sq.m/Day	DS1
4	2012	Settleable Dust (Bergerhoff Method)	98	mg/sq.m/Day	DS2
4	2012	Settleable Dust (Bergerhoff Method)	110	mg/sq.m/Day	DS3
4	2012	Settleable Dust (Bergerhoff Method)	142	mg/sq.m/Day	DS4
4	2012	Settleable Dust (Bergerhoff Method)	153	mg/sq.m/Day	DS5
5	2012	Settleable Dust (Bergerhoff Method)	10	mg/sq.m/Day	DS1
5	2012	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS2
5	2012	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS3
5	2012	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS4
5	2012	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS5
7	2012	Settleable Dust (Bergerhoff Method)	171	mg/sq.m/Day	DS1
7	2012	Settleable Dust (Bergerhoff Method)	194	mg/sq.m/Day	DS2
7	2012	Settleable Dust (Bergerhoff Method)	209	mg/sq.m/Day	DS3
7	2012	Settleable Dust (Bergerhoff Method)	165	mg/sq.m/Day	DS4
7	2012	Settleable Dust (Bergerhoff Method)	182	mg/sq.m/Day	DS5
8	2012	Settleable Dust (Bergerhoff Method)	128	mg/sq.m/Day	DS1

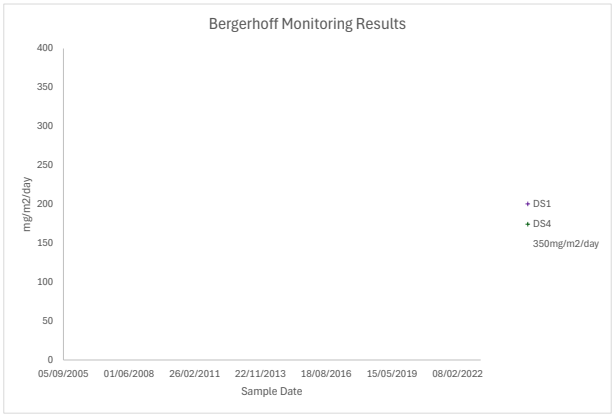
8	2012	Settleable Dust (Bergerhoff Method)	80	mg/sq.m/Day	DS2
8	2012	Settleable Dust (Bergerhoff Method)	127	mg/sq.m/Day	DS3
8	2012	Settleable Dust (Bergerhoff Method)	111	mg/sq.m/Day	DS4
8	2012	Settleable Dust (Bergerhoff Method)	145	mg/sq.m/Day	DS5
10	2012	Settleable Dust (Bergerhoff Method)	948	mg/sq.m/Day	DS1
10	2012	Settleable Dust (Bergerhoff Method)	1168	mg/sq.m/Day	DS2
10	2012	Settleable Dust (Bergerhoff Method)	807	mg/sq.m/Day	DS3
10	2012	Settleable Dust (Bergerhoff Method)	713	mg/sq.m/Day	DS4
10	2012	Settleable Dust (Bergerhoff Method)	924	mg/sq.m/Day	DS5
11	2012	Settleable Dust (Bergerhoff Method)	124	mg/sq.m/Day	DS1
11	2012	Settleable Dust (Bergerhoff Method)	179	mg/sq.m/Day	DS2
11	2012	Settleable Dust (Bergerhoff Method)	177	mg/sq.m/Day	DS3
11	2012	Settleable Dust (Bergerhoff Method)	179	mg/sq.m/Day	DS4
11	2012	Settleable Dust (Bergerhoff Method)	171	mg/sq.m/Day	DS5
12	2012	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS1
12	2012	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS2
12	2012	Settleable Dust (Bergerhoff Method)	87	mg/sq.m/Day	DS3
12	2012	Settleable Dust (Bergerhoff Method)	98	mg/sq.m/Day	DS4
12	2012	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS5
1	2011	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS1
1	2011	Settleable Dust (Bergerhoff Method)	33	mg/sq.m/Day	DS2
1	2011	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS3
1	2011	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS4
1	2011	Settleable Dust (Bergerhoff Method)	143	mg/sq.m/Day	DS5
2	2011	Settleable Dust (Bergerhoff Method)	73	mg/sq.m/Day	DS1
2	2011	Settleable Dust (Bergerhoff Method)	130	mg/sq.m/Day	DS2
2	2011	Settleable Dust (Bergerhoff Method)	96	mg/sq.m/Day	DS3
2	2011	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS4
2	2011	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS5
3	2011	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS1
3	2011	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS2
3	2011	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS3
3	2011	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS4
3	2011	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS5
4	2011	Settleable Dust (Bergerhoff Method)	42	mg/sq.m/Day	DS1
4	2011	Settleable Dust (Bergerhoff Method)	106	mg/sq.m/Day	DS2
4	2011	Settleable Dust (Bergerhoff Method)	50	mg/sq.m/Day	DS3
4	2011	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS4
4	2011	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS5
5	2011	Settleable Dust (Bergerhoff Method)	92	mg/sq.m/Day	DS1
5	2011	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS2
5	2011	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS3
5	2011	Settleable Dust (Bergerhoff Method)	127	mg/sq.m/Day	DS4
5	2011	Settleable Dust (Bergerhoff Method)	62	mg/sq.m/Day	DS5
6	2011	Settleable Dust (Bergerhoff Method)	18	mg/sq.m/Day	DS1
6	2011	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS2
6	2011	Settleable Dust (Bergerhoff Method)	98	mg/sq.m/Day	DS3
6	2011	Settleable Dust (Bergerhoff Method)	68	mg/sq.m/Day	DS4
6	2011	Settleable Dust (Bergerhoff Method)	113	mg/sq.m/Day	DS5
8	2011	Settleable Dust (Bergerhoff Method)	138	mg/sq.m/Day	DS1
8	2011	Settleable Dust (Bergerhoff Method)	83	mg/sq.m/Day	DS2

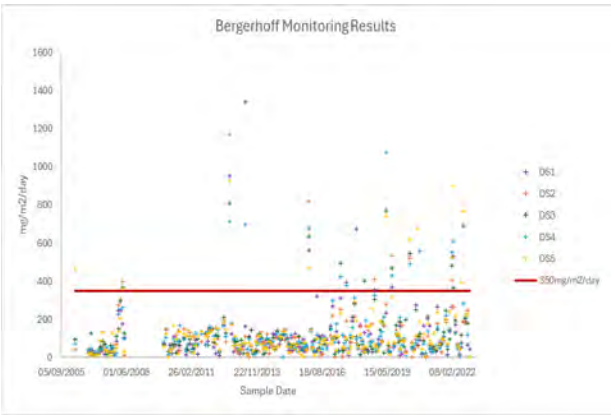
8	2011	Settleable Dust (Bergerhoff Method)	136	mg/sq.m/Day	DS3
8	2011	Settleable Dust (Bergerhoff Method)	122	mg/sq.m/Day	DS4
8	2011	Settleable Dust (Bergerhoff Method)	136	mg/sq.m/Day	DS5
10	2011	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS1
10	2011	Settleable Dust (Bergerhoff Method)	119	mg/sq.m/Day	DS2
10	2011	Settleable Dust (Bergerhoff Method)	126	mg/sq.m/Day	DS3
10	2011	Settleable Dust (Bergerhoff Method)	65	mg/sq.m/Day	DS4
10	2011	Settleable Dust (Bergerhoff Method)	108	mg/sq.m/Day	DS5
11	2011	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS1
11	2011	Settleable Dust (Bergerhoff Method)	106	mg/sq.m/Day	DS2
11	2011	Settleable Dust (Bergerhoff Method)	67	mg/sq.m/Day	DS3
11	2011	Settleable Dust (Bergerhoff Method)	137	mg/sq.m/Day	DS4
11	2011	Settleable Dust (Bergerhoff Method)	125	mg/sq.m/Day	DS5
12	2011	Settleable Dust (Bergerhoff Method)	152	mg/sq.m/Day	DS1
12	2011	Settleable Dust (Bergerhoff Method)	144	mg/sq.m/Day	DS2
12	2011	Settleable Dust (Bergerhoff Method)	154	mg/sq.m/Day	DS3
12	2011	Settleable Dust (Bergerhoff Method)	158	mg/sq.m/Day	DS4
12	2011	Settleable Dust (Bergerhoff Method)	129	mg/sq.m/Day	DS5
1	2010	Settleable Dust (Bergerhoff Method)	73	mg/sq.m/Day	DS1
1	2010	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS2
1	2010	Settleable Dust (Bergerhoff Method)	65	mg/sq.m/Day	DS3
1	2010	Settleable Dust (Bergerhoff Method)	79	mg/sq.m/Day	DS4
1	2010	Settleable Dust (Bergerhoff Method)	58	mg/sq.m/Day	DS5
2	2010	Settleable Dust (Bergerhoff Method)	146	mg/sq.m/Day	DS1
2	2010	Settleable Dust (Bergerhoff Method)	150	mg/sq.m/Day	DS2
2	2010	Settleable Dust (Bergerhoff Method)	124	mg/sq.m/Day	DS3
2	2010	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS4
2	2010	Settleable Dust (Bergerhoff Method)	123	mg/sq.m/Day	DS5
3	2010	Settleable Dust (Bergerhoff Method)	1	mg/sq.m/Day	DS1
3	2010	Settleable Dust (Bergerhoff Method)	1	mg/sq.m/Day	DS2
3	2010	Settleable Dust (Bergerhoff Method)	30	mg/sq.m/Day	DS3
3	2010	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS4
3	2010	Settleable Dust (Bergerhoff Method)	1	mg/sq.m/Day	DS5
4	2010	Settleable Dust (Bergerhoff Method)	64	mg/sq.m/Day	DS1
4	2010	Settleable Dust (Bergerhoff Method)	41	mg/sq.m/Day	DS2
4	2010	Settleable Dust (Bergerhoff Method)	19	mg/sq.m/Day	DS3
4	2010	Settleable Dust (Bergerhoff Method)	21	mg/sq.m/Day	DS4
4	2010	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS5
5	2010	Settleable Dust (Bergerhoff Method)	20	mg/sq.m/Day	DS1
5	2010	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS2
5	2010	Settleable Dust (Bergerhoff Method)	67	mg/sq.m/Day	DS3
5	2010	Settleable Dust (Bergerhoff Method)	51	mg/sq.m/Day	DS4
5	2010	Settleable Dust (Bergerhoff Method)	46	mg/sq.m/Day	DS5
6	2010	Settleable Dust (Bergerhoff Method)	107	mg/sq.m/Day	DS1
6	2010	Settleable Dust (Bergerhoff Method)	54	mg/sq.m/Day	DS2
6	2010	Settleable Dust (Bergerhoff Method)	70	mg/sq.m/Day	DS3
6	2010	Settleable Dust (Bergerhoff Method)	93	mg/sq.m/Day	DS4
6	2010	Settleable Dust (Bergerhoff Method)	169	mg/sq.m/Day	DS5
7	2010	Settleable Dust (Bergerhoff Method)	66	mg/sq.m/Day	DS1
7	2010	Settleable Dust (Bergerhoff Method)	118	mg/sq.m/Day	DS2
7	2010	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS3

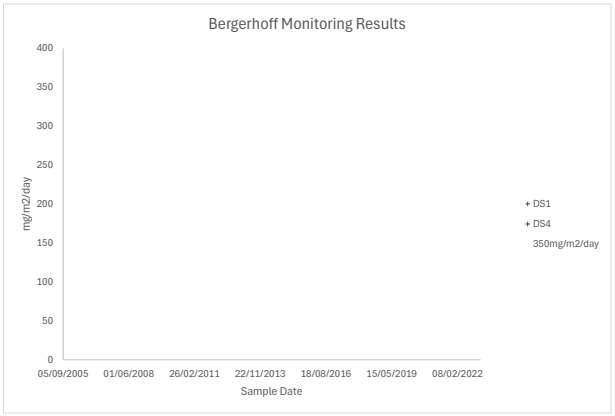
7	2010	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS4
7	2010	Settleable Dust (Bergerhoff Method)	95	mg/sq.m/Day	DS5
8	2010	Settleable Dust (Bergerhoff Method)	32	mg/sq.m/Day	DS1
8	2010	Settleable Dust (Bergerhoff Method)	139	mg/sq.m/Day	DS2
8	2010	Settleable Dust (Bergerhoff Method)	67	mg/sq.m/Day	DS3
8	2010	Settleable Dust (Bergerhoff Method)	87	mg/sq.m/Day	DS4
8	2010	Settleable Dust (Bergerhoff Method)	18	mg/sq.m/Day	DS5
9	2010	Settleable Dust (Bergerhoff Method)	63	mg/sq.m/Day	DS1
9	2010	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS2
9	2010	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS3
9	2010	Settleable Dust (Bergerhoff Method)	169	mg/sq.m/Day	DS4
9	2010	Settleable Dust (Bergerhoff Method)	132	mg/sq.m/Day	DS5
11	2010	Settleable Dust (Bergerhoff Method)	103	mg/sq.m/Day	DS1
11	2010	Settleable Dust (Bergerhoff Method)	148	mg/sq.m/Day	DS2
11	2010	Settleable Dust (Bergerhoff Method)	97	mg/sq.m/Day	DS3
11	2010	Settleable Dust (Bergerhoff Method)	94	mg/sq.m/Day	DS4
11	2010	Settleable Dust (Bergerhoff Method)	123	mg/sq.m/Day	DS5
12	2010	Settleable Dust (Bergerhoff Method)	13	mg/sq.m/Day	DS1
12	2010	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS2
12	2010	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS3
12	2010	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS4
12	2010	Settleable Dust (Bergerhoff Method)	114	mg/sq.m/Day	DS5
1	2008	Settleable Dust (Bergerhoff Method)	85	mg/sq.m/Day	DS1
1	2008	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS2
1	2008	Settleable Dust (Bergerhoff Method)	109	mg/sq.m/Day	DS3
1	2008	Settleable Dust (Bergerhoff Method)	23	mg/sq.m/Day	DS4
1	2008	Settleable Dust (Bergerhoff Method)	48	mg/sq.m/Day	DS5
2	2008	Settleable Dust (Bergerhoff Method)	245	mg/sq.m/Day	DS1
2	2008	Settleable Dust (Bergerhoff Method)	275	mg/sq.m/Day	DS2
2	2008	Settleable Dust (Bergerhoff Method)	148	mg/sq.m/Day	DS3
2	2008	Settleable Dust (Bergerhoff Method)	226	mg/sq.m/Day	DS4
2	2008	Settleable Dust (Bergerhoff Method)	136	mg/sq.m/Day	DS5
3	2008	Settleable Dust (Bergerhoff Method)	245	mg/sq.m/Day	DS1
3	2008	Settleable Dust (Bergerhoff Method)	305	mg/sq.m/Day	DS2
3	2008	Settleable Dust (Bergerhoff Method)	296	mg/sq.m/Day	DS3
3	2008	Settleable Dust (Bergerhoff Method)	253	mg/sq.m/Day	DS4
3	2008	Settleable Dust (Bergerhoff Method)	204	mg/sq.m/Day	DS5
4	2008	Settleable Dust (Bergerhoff Method)	174	mg/sq.m/Day	DS1
4	2008	Settleable Dust (Bergerhoff Method)	399	mg/sq.m/Day	DS2
4	2008	Settleable Dust (Bergerhoff Method)	368	mg/sq.m/Day	DS3
4	2008	Settleable Dust (Bergerhoff Method)	262	mg/sq.m/Day	DS4
4	2008	Settleable Dust (Bergerhoff Method)	362	mg/sq.m/Day	DS5
5	2008	Settleable Dust (Bergerhoff Method)	105	mg/sq.m/Day	DS1
5	2008	Settleable Dust (Bergerhoff Method)	11	mg/sq.m/Day	DS2
5	2008	Settleable Dust (Bergerhoff Method)	126	mg/sq.m/Day	DS3
5	2008	Settleable Dust (Bergerhoff Method)	99	mg/sq.m/Day	DS4
5	2008	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS5
1	2007	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS1
1	2007	Settleable Dust (Bergerhoff Method)	21	mg/sq.m/Day	DS2
1	2007	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS3
1	2007	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS4

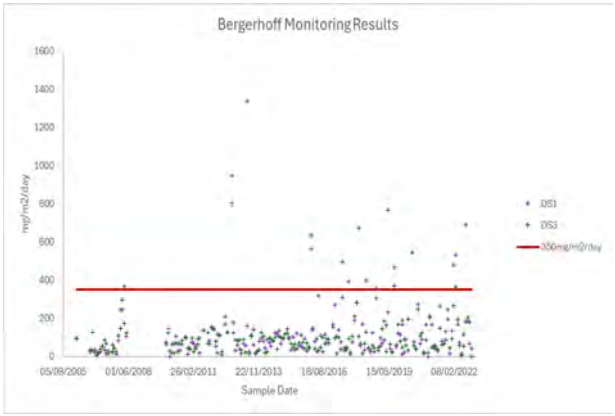
1	2007	Settleable Dust (Bergerhoff Method)	18	mg/sq.m/Day	DS5
2	2007	Settleable Dust (Bergerhoff Method)	22	mg/sq.m/Day	DS1
2	2007	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS2
2	2007	Settleable Dust (Bergerhoff Method)	6	mg/sq.m/Day	DS3
2	2007	Settleable Dust (Bergerhoff Method)	9	mg/sq.m/Day	DS4
2	2007	Settleable Dust (Bergerhoff Method)	7	mg/sq.m/Day	DS5
3	2007	Settleable Dust (Bergerhoff Method)	19	mg/sq.m/Day	DS1
3	2007	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS2
3	2007	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS3
3	2007	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS4
3	2007	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS5
4	2007	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS1
4	2007	Settleable Dust (Bergerhoff Method)	13	mg/sq.m/Day	DS2
4	2007	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS3
4	2007	Settleable Dust (Bergerhoff Method)	19	mg/sq.m/Day	DS4
4	2007	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS5
5	2007	Settleable Dust (Bergerhoff Method)	55	mg/sq.m/Day	DS1
5	2007	Settleable Dust (Bergerhoff Method)	29	mg/sq.m/Day	DS2
5	2007	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS3
5	2007	Settleable Dust (Bergerhoff Method)	40	mg/sq.m/Day	DS4
5	2007	Settleable Dust (Bergerhoff Method)	89	mg/sq.m/Day	DS5
6	2007	Settleable Dust (Bergerhoff Method)	35	mg/sq.m/Day	DS1
6	2007	Settleable Dust (Bergerhoff Method)	60	mg/sq.m/Day	DS2
6	2007	Settleable Dust (Bergerhoff Method)	86	mg/sq.m/Day	DS3
6	2007	Settleable Dust (Bergerhoff Method)	47	mg/sq.m/Day	DS4
6	2007	Settleable Dust (Bergerhoff Method)	131	mg/sq.m/Day	DS5
7	2007	Settleable Dust (Bergerhoff Method)	17	mg/sq.m/Day	DS1
7	2007	Settleable Dust (Bergerhoff Method)	72	mg/sq.m/Day	DS2
7	2007	Settleable Dust (Bergerhoff Method)	69	mg/sq.m/Day	DS3
7	2007	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS4
7	2007	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS5
8	2007	Settleable Dust (Bergerhoff Method)	30	mg/sq.m/Day	DS1
8	2007	Settleable Dust (Bergerhoff Method)	36	mg/sq.m/Day	DS2
8	2007	Settleable Dust (Bergerhoff Method)	16	mg/sq.m/Day	DS3
8	2007	Settleable Dust (Bergerhoff Method)	54	mg/sq.m/Day	DS4
8	2007	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS5
10	2007	Settleable Dust (Bergerhoff Method)	26	mg/sq.m/Day	DS1
10	2007	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS1
10	2007	Settleable Dust (Bergerhoff Method)	38	mg/sq.m/Day	DS2
10	2007	Settleable Dust (Bergerhoff Method)	27	mg/sq.m/Day	DS2
10	2007	Settleable Dust (Bergerhoff Method)	62	mg/sq.m/Day	DS3
10	2007	Settleable Dust (Bergerhoff Method)	23	mg/sq.m/Day	DS3
10	2007	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS4
10	2007	Settleable Dust (Bergerhoff Method)	12	mg/sq.m/Day	DS4
10	2007	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS5
10	2007	Settleable Dust (Bergerhoff Method)	11	mg/sq.m/Day	DS5
11	2007	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS1
11	2007	Settleable Dust (Bergerhoff Method)	61	mg/sq.m/Day	DS2
11	2007	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS3
11	2007	Settleable Dust (Bergerhoff Method)	53	mg/sq.m/Day	DS4
11	2007	Settleable Dust (Bergerhoff Method)	126	mg/sq.m/Day	DS5

12	2007	Settleable Dust (Bergerhoff Method)	12	mg/sq.m/Day	DS1
12	2007	Settleable Dust (Bergerhoff Method)	15	mg/sq.m/Day	DS2
12	2007	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS3
12	2007	Settleable Dust (Bergerhoff Method)	9	mg/sq.m/Day	DS4
12	2007	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS5
4	2006	Settleable Dust (Bergerhoff Method)	94	mg/sq.m/Day	DS1
4	2006	Settleable Dust (Bergerhoff Method)	39	mg/sq.m/Day	DS2
4	2006	Settleable Dust (Bergerhoff Method)	96	mg/sq.m/Day	DS3
4	2006	Settleable Dust (Bergerhoff Method)	73	mg/sq.m/Day	DS4
4	2006	Settleable Dust (Bergerhoff Method)	465	mg/sq.m/Day	DS5
11	2006	Settleable Dust (Bergerhoff Method)	34	mg/sq.m/Day	DS1
11	2006	Settleable Dust (Bergerhoff Method)	44	mg/sq.m/Day	DS2
11	2006	Settleable Dust (Bergerhoff Method)	25	mg/sq.m/Day	DS3
11	2006	Settleable Dust (Bergerhoff Method)	37	mg/sq.m/Day	DS4
11	2006	Settleable Dust (Bergerhoff Method)	20	mg/sq.m/Day	DS5
12	2006	Settleable Dust (Bergerhoff Method)	31	mg/sq.m/Day	DS1
12	2006	Settleable Dust (Bergerhoff Method)	12	mg/sq.m/Day	DS2
12	2006	Settleable Dust (Bergerhoff Method)	128	mg/sq.m/Day	DS3
12	2006	Settleable Dust (Bergerhoff Method)	45	mg/sq.m/Day	DS4
12	2006	Settleable Dust (Bergerhoff Method)	24	mg/sq.m/Day	DS5


Bergerhoff Monitoring Results
400
350
300
250
200
150
100
50
0
mg/m2/day
05/09/2005
01/06/2008
26/02/2011
22/11/2013
18/08/2016
15/05/2019
08/02/2022
Sample Date
DS1
DS4
350mg/m2/day


Bergerhoff Monitoring Results
1600
1400
1200
1000
800
600
400
200
0
mg/m2/day
05/09/2005
01/06/2008
26/02/2011
22/11/2013
18/08/2016
15/05/2019
08/02/2022
Sample Date
DS1
DS2
DS3
DS4
DS5
350mg/m2/day


Bergerhoff Monitoring Results
400
350
300
250
200
150
100
50
0
mg/m2/day
05/09/2005
01/06/2008
26/02/2011
22/11/2013
18/08/2016
15/05/2019
08/02/2022
Sample Date
DS1
DS4
350mg/m2/day


Bergerhoff Monitoring Results
1600
1400
1200
1000
800
600
400
200
0
mg/m2/day
05/09/2005
01/06/2008
26/02/2011
22/11/2013
18/08/2016
15/05/2019
08/02/2022
Sample Date
DS1
DS3
350mg/m2/day

169
338
5.92%

Appendix 9-4

TECHNICAL NOTE

MALONE O'REGAN ENVIRONMENTAL

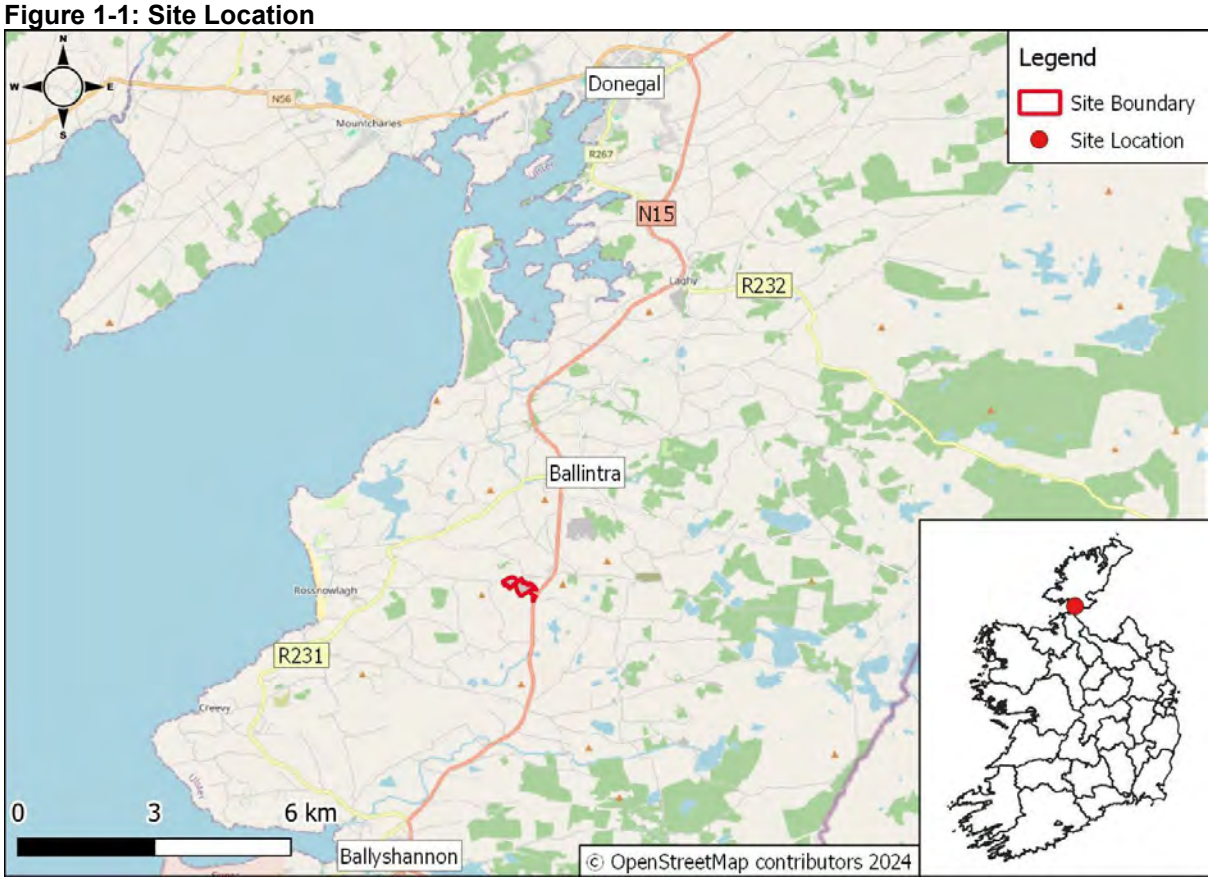
E2321, Ambient PM10 Monitoring, Ballymagroarty Quarry, Co. Donegal

Technical Note Publish Date: 26/02/2025.

1 INTRODUCTION

Malone O'Regan Environmental ('MOR Environmental') was commissioned by Patrick McCaffrey and Sons Ltd ('the Client') to undertake ambient PM_{10} monitoring at its active quarry in Ballymagroarty, Co. Donegal, hereafter referred to as 'the Site'. The Site location is shown in Figure 1-1 below.

Figure 1-1: Site Location



Experienced MOR Environmental personnel installed a PM_{10} monitor (Osiris TNO4361) on-site, which observed PM_{10} concentrations from November 28th to December 5th, 2024. November 28th, the date of set-up, and December 5th, the date of collection, are excluded from the assessment as the data measured on those dates does not consist of a full 24-hour measurement period. The PM_{10} monitor was calibrated in accordance with the manufacturer's instructions.

The PM_{10} monitoring location was located at grid reference ITM 590731 867573.

The unit was set up north of the active quarry. The location of the PM_{10} monitor is shown in Figure 1-2 below.

The monitoring results include cumulative PM_{10} concentrations comprising:

- Background suspended PM10 concentrations in the area; and,
- Suspended PM10 resulting from Site activities.

The following observations were made during PM_{10} monitoring set-up and collection:

- The concrete batching plant and other plant / machinery were operational;
- Material handling/transportation was occurring; and,
- The Site does not conduct aggregate extraction, though aggregate stockpiles from off-site sources and on-site processing were present.

Figure 1-2: Location of PM_{10} Monitor at Ballymagroarty Quarry

2 METHODOLOGY

The assessment includes for the collection of particulate matter, weather metrics and long-term regional particulate matter data. The methodologies employed for each task are presented below.

2.1 Weather Station Data

A Davis Vantage Vue weather station was installed on-site within ca. 5 metres of the PM_{10} unit by experienced MOR Environmental personnel to collect weather data. A set-up photo of the Davis Vantage Vue weather station and the Osirus PM_{10} equipment is presented in Figure 2-1 below. The wind rose that displays the dominant wind direction and wind speed is presented in Figure 2-2 below.

A summary of the recorded 24-hour wind speed and rainfall is also provided; refer to Table 2-1 below.

Figure 2-1: Osirus PM_{10} Unit and Davis Vantage Vue weather station.

Figure 2-2: Wind rose from 29/11/2024 to 04/12/2024 at the Site.

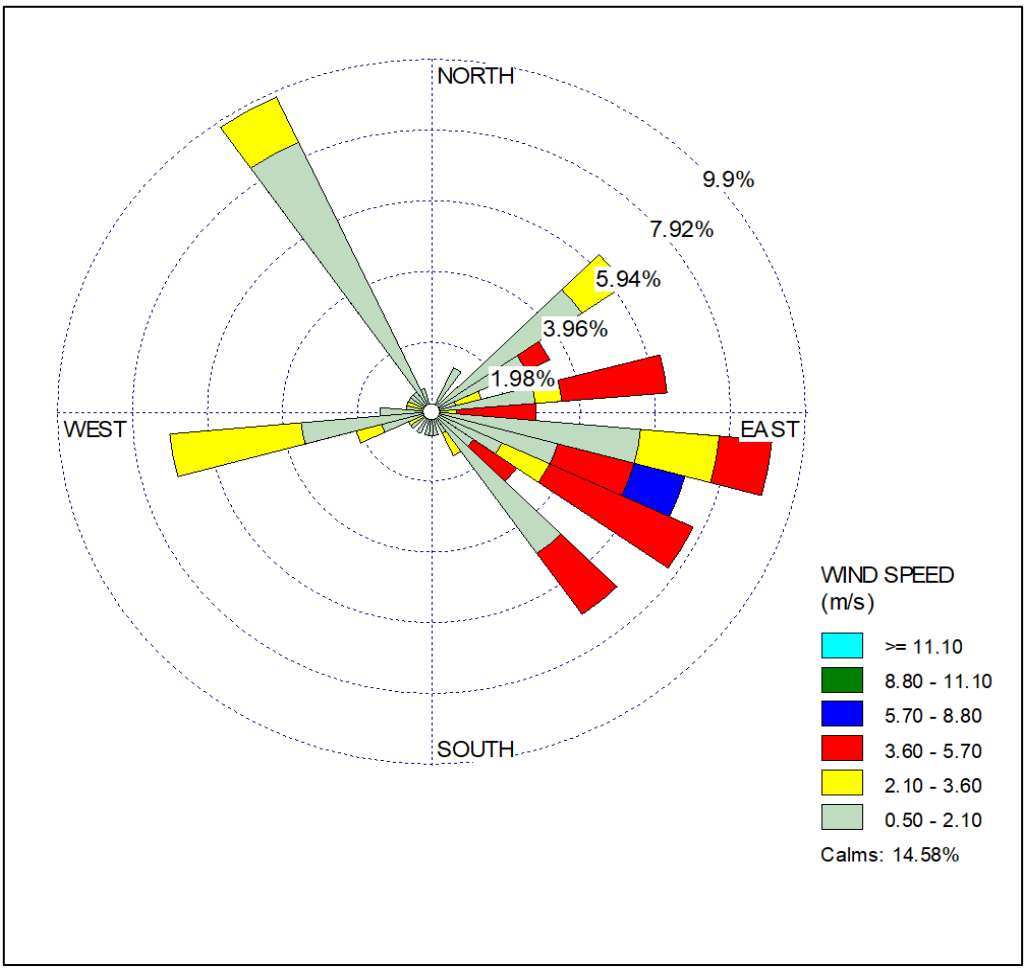


Table 2-1: Weather data obtained from the on-site weather station.

Date	Mean wind speed (m/s)	Mean Rainfall (mm)
29/11/2024	3.8	0.25
30/11/2024	2.8	0.25
01/12/2024	1.7	5.56
02/12/2024	1.0	6.08
03/12/2024	1.3	7.35
04/12/2024	2.2	3.55
Average	**2.1**	**3.80**

2.2 Air Quality Standards

Table 2-2 below lists the applicable air quality standards ('AQS') for PM_{10}, as set out in the Air Quality Directive (2008/50/EC) and S.I. No. 180 of 2011.

Table 2-2: Air Quality Standards ('AQS') for PM_{10}

Pollutant	Concentration	Maximum No. of Exceedances permitted	Exceedance Expressed as Percentile	Measured as
Particulates (PM_{10})	50µg/m^3	35 times in a year	90.40th percentile	24-hour mean
	40µg/m^3	None	-	Annual mean

2.3 Background Air Quality

EU legislation on air quality requires that all Member States divide their territory into zones for the assessment and management of air quality. The current trends in air quality in Ireland are reported in the Environmental Protection Agency's ('EPA') publication 'Air Quality in Ireland – Annual Report 2023', which is the most up-to-date report on air quality in Ireland.

For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the Air Quality Standards ('AQS') Regulations (S.I. No. 180 of 2011) and are defined as follows:

- **Zone A**: Dublin Conurbation;
- **Zone B**: Cork Conurbation;
- **Zone C**: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip; and,
- **Zone D**: Rural Ireland, i.e., the remainder of the State excluding Zones A, B & C.

According to EPA Envision mapping, the Site is located within Zone D, Rural Ireland. According to the above classification, it is considered that average Zone D air quality is representative of the background concentration of pollutants at the Site.

Table 2-3 below shows the baseline air quality data measured by the EPA at Zone D monitoring locations from 2019 to 2023.

Table 2-3: Annual Mean Concentration of Pollutants Measured in Zone D obtained from the EPA

Monitoring Stations	Total Particulates PM_{10} Annual Mean (µg/m^3)				
	2019	2020	2021	2022	2023
Tipperary Town	9	12	12.7	13.9	10.8
Carrick-on-Shannon		10	9.4	10.2	8.9
Askeaton		7	8.7		
Shannon Estuary and Askeaton*				9.4	8.4
Enniscorthy	18	15	13.7	15	13.3
Birr		10	12.2	14.5	13.1
Macroom	28	15	14.6	16.1	11.3
Castlebar	16	14	9.8	11.2	9.9
Cobh Carrignafoy	13	13	12	13.2	11.8
Claremorris	11	10	9.5	7.9	8.1

Monitoring Stations	Total Particulates PM_{10} Annual Mean (µg/m³)				
	2019	2020	2021	2022	2023
Kilkitt	7	8	7.8	8.5	7.1
Cavan		9	10.6	11	10
Roscommon Town	12	11	10.3	11.2	9.7
Edenderry			17.8	17.7	16.3
Mallow			14.7	13.5	10.5
Longford			13.9	16	13.1
Cobh Cork Harbour			13.4	14.4	11.4
Killarney, Co. Kerry				9.1	8.9
Malin Head					12.8
Average Zone D	14.3	11.2	11.9	12.7	10.9

*Shannon Estuary and Askeaton EPA monitoring data was combined from 2022 onwards due to the close proximity of both monitoring stations.

The overall average annual concentration of PM_{10} for the Zone D monitoring locations from 2019-2023 is 12.18µg/m^3. The average of the 5 most recent years of available EPA data for Zone D was taken (2019-2023) as the long-term background concentration for the Site.

The closest EPA monitoring station to the Site that monitors PM_{10} at an hourly rate is at Sligo Town, Co. Sligo (Station 77 Zone C Urban Town), located ca. 50km to the south. The station provides continuous PM_{10} data as part of the EPA's 'Air Quality for Health' initiative.

The 24-hour mean concentrations for the Sligo EPA station ranged between 7.8µg/m^3 and 37.3µg/m^3 for the monitoring event (from 29th November and 4th December 2024). The mean concentration across the monitoring period was 15.4µg/m^3.

3 MONITORING RESULTS

Table 3-1 below details PM_{10} monitoring results collated for the Site during the monitoring event. The data and results are presented in a graphical format in the context of the 24-hour AQS for PM_{10}, and PM_{10} data monitored by the Osiris PM_{10} unit for this monitoring event.

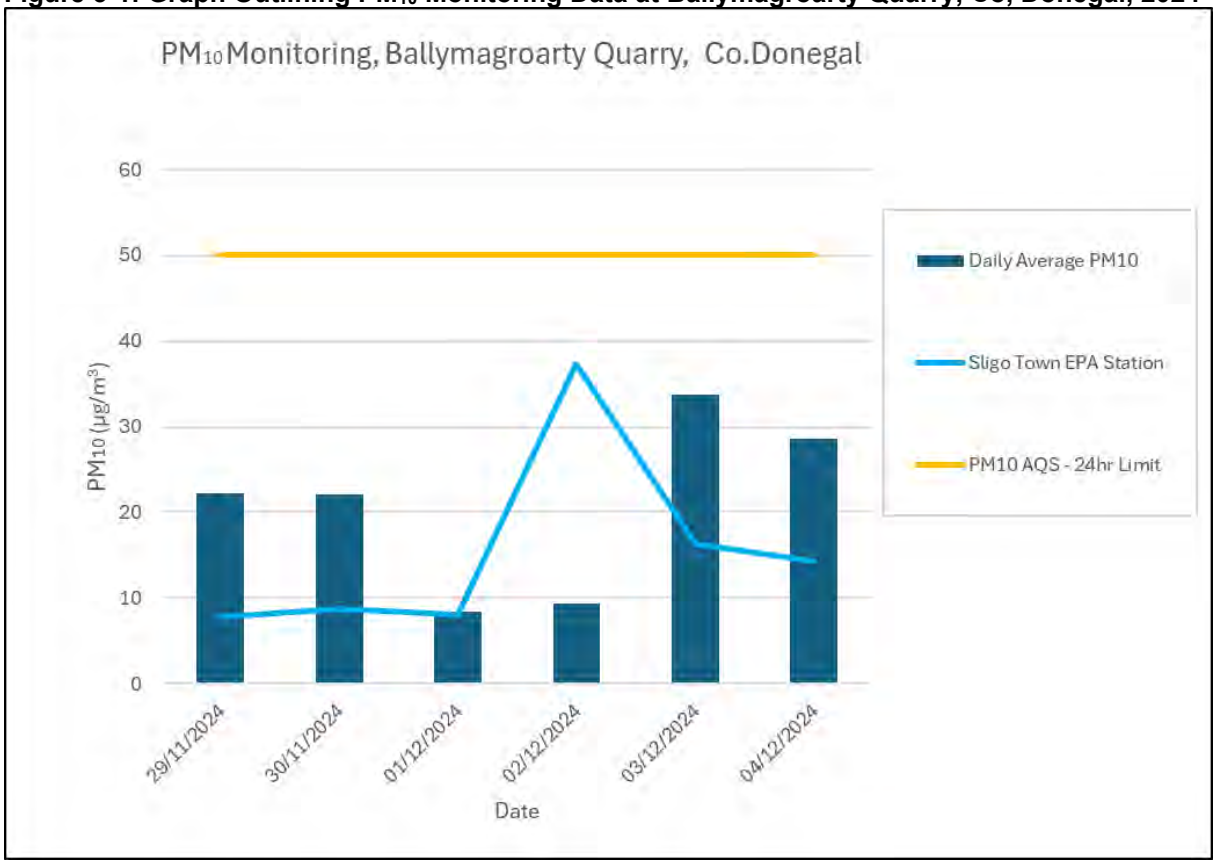
Table 3-1: PM_{10} Monitoring Results for Ballymagroarty Quarry, Co. Donegal, 2024.

Monitoring event	Monitored PM_{10} µg/m^3 24-hour mean	% of 24-hour mean AQS
29/11/2024 Friday	22.19	44%
30/11/2024 Saturday	22.06	44%
01/12/2024 Sunday	8.45	17%
02/12/2024 Monday	9.32	19%
03/12/2024 Tuesday	33.79	68%
04/12/2024 Wednesday	28.63	57%
Average for the monitoring event (29/11/2024 to 04/12/2024).	**20.74**	**52%**

The maximum PM_{10} concentration recorded was 33.79µg/m^3 on 3rd of December 2024. The minimum PM_{10} concentration 8.45µg/m^3 was recorded on 1st of December 2024. The average concentration of ambient PM_{10} detected during the monitoring event was 20.74µg/m^3 which is

below the daily and annual mean AQS limit. The concentration of PM_{10} ranged from 1 Good (0-16µg/m^3) to 2 Good (17-33µg/m^3) on the EPAs Air Quality Index for Health during the monitoring period. The Air Quality Index can be found on the EPA Website at https://airquality.ie/information/air-quality-index-for-health.

Figure 3-1: Graph Outlining PM_{10} Monitoring Data at Ballymagroarty Quarry, Co, Donegal, 2024



The 24-hour concentration of ambient PM_{10} measured on-site during the monitoring event was below the 24-hour mean AQS limit (50µg/m^3) and the annual mean AQS limit (40µg/m^3). (see Figure 3-1 above).

4 CONCLUSION

Based on the PM_{10} data presented, the following can be concluded:

- The Site is located within a setting of Rural Ireland, Zone D (i.e. Zone D – EPA Zoning);
- The average Annual Mean concentration based on the monitoring completed by the EPA between 2019-2023 for PM_{10} in Zone D, i.e. Rural Ireland, is 12.4µg/m^3; and,
- All values recorded during this monitoring event were within the EPA's criteria for '1-good' air quality (0-16 µg/m^3) and '2- good' – air quality (17-33 µg/m^3) for EPAs Air Quality Index for Health.

Over the monitoring event from November 29th to December 4th, the following was noted:

- The average 24-hour mean for the monitoring event was 20.74µg/m^3, which is:
    - 41% of the daily AQS limit value of 50µg/m^3; and,
    - 52% of the AQS annual mean limit of 40µg/m^3.
- Generally, the measured on-site PM_{10} results were elevated in comparison to the continuous EPA monitoring data from Station 77 Sligo Town during the November 29th–December 4th monitoring period. However, monitoring results remained below all AQS limits; and,
- A spike in the Sligo town data set on the Sunday, was higher than any daily average value recorded form the on-site monitor.

Yours sincerely,

for Malone O'Regan Environmental

Dylan Morris

Dylan Morris **Kenneth Goodwin**

Date: 26 February 2025

Copyright and Third-Party Disclaimer

Malone O'Regan Environmental ('MOR Environmental') has prepared this document for the sole use of our client in accordance with the Client's instructions using all reasonable skill and competence and generally accepted consultancy principles. The document was prepared in accordance with the budget and terms of reference agreed with the Client and does not in any way constitute advice to any third party who is able to access it by any means. MOR Environmental excludes to the fullest extent lawfully permitted all liability whatsoever for any costs, liabilities or losses arising as a result of or reliance upon the contents of this report by any person or legal entity (other than the Client in accordance with the terms of reference). MOR Environmental has not verified any documents or information supplied by third parties and referred to herein in compiling this document, and no warranty is provided as part of this document. No part of this document may be copied or reproduced without express written confirmation from MOR Environmental. Any methodology contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of MOR Environmental. Disclosure of such information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Third parties who obtain access to this document by any means, including disclosure by the Client, will be subject to the Copyright and Third-Party Disclaimer contained herein.

APPENDIX 9-5

Date	SO2 (mg/Nm3)	NOx (mg/Nm3)	CO (mg/Nm3)	O2 (%)	PM (mg/Nm3)	CO2 (%)	Volumetric Flow (m3/hr)
17/01/2012	78	28	-	-	-	-	-
29/11/2012	59	23	-	-	-	-	-
27/11/2013	48	97	-	19.5	-	-	-
09/12/2014	28.1	38	344.6	-	-	-	-
25/11/2015	32.3	4.9	180.8	19.79	-	-	-
28/11/2016	26	2.1	226.1	19.82	-	-	-
30/11/2017	46.1	1	294.3	20	-	-	-
05/12/2018	0.31	3.2	210.5	19.8	-	-	-
14/11/2019	<6.1	20.3	-	18.4	<23	1.9	43976
17/12/2020	3.9	2.9	192.2	19.8	-	0.9	-
01/07/2021	7.5	2.8	124.1	19.8	103.28	0.7	33532
02/03/2023	9.6	28.5	129.4	18.12	-	2.3	-
Limit	500	450	10000	-	-	-	-

APPENDIX 11

APPENDIX 11-1

Glossary of Acoustic Terminology

Abbreviation / Descriptor	Description
A Weighted	A time weighting given to noise values to amend the values to suit the human ear response to the various frequency components of the sound.
Acoustic environment	Sound from all sound sources as modified by the environment (BS ISO 12913-1:2013).
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far. *Note: The ambient sound comprises the residual sound and the specific sound when present.*
Ambient sound level, L_a = $L_{Aeq,\,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. *Note: the ambient sound level is a measure of the residual sound and the specific sound when present.*
Background sound level, $L_{A90,\,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
dB (decibel)	A relative unit of measurements, based on a logarithmic scale to describe the ratio between the measured level and a reference or threshold level of 0dB. Unless otherwise stated 0dB within this report is $2x10^{-5}$ pascals (Pa).
Day	A 24 hour period from midnight to midnight.
Daytime	A 12 hour period between 07:00 – 19:00 hours, as per NG4
Evening-Time	A 4 hour period between 19:00 – 23:00 hours, as per NG4
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,\,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T=t_2-t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given the following equation: $L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]dt\right\}$ where: p_0 is the reference sound pressure (20 µPa); and $p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t *Note: The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.*
$L_{AN,T}$	The Fast interval, A-Weighted noise level in the for the 'N' percentile of the sampling interval 'T'.
$L_{A10,T}$	The A-Weighted noise level for the 10%ile of the sampling interval 'T', typically utilised to represent peak noise events such as intermittent passing traffic.
$L_{A90,T}$	The A-Weighted noise level in the lower 90 percentile of the sampling interval 'T', excludes intermittent features typical of traffic. See also background sound level.
$L_{A95,T}$	The A-Weighted noise level for the 95%ile of the sampling interval 'T'. Representative of steady noise events at a monitoring location.

$L_{Aeq,T}$	The equivalent continuous sound level, used to describe the fluctuating noise in terms of a single noise level over the same sampling time period (T). Also see ambient sound.
L_{den}	Day-evening-night equivalent level, calculated as: $Lden = 10Log\frac{1}{24}\left(12*10\frac{Lday}{10}+4*10\frac{Levening+5}{10}+8*10\frac{Lnight+10}{10}\right)$ Where the L_{day}, $L_{evening}$ and L_{night} are as defined in ISO1996-2:1987, and for the duration of 12 hours, 4 hours and 8 hours respectively, are A-weighted long term Leq sound level.
L_{day}	Day equivalent level. A-weighted Leq sound level measured over the 12 hour period from 07:00 hours to 19:00 hours.
$L_{evening}$	Evening equivalent level. A-weighted Leq sound level measured during the evening period of 19:00 hours to 23:00 hours.
L_{Amax}	The maximum RMS A-Weighted sound pressure level occurring within a specified time period.
L_{night}	Night equivalent level. A-weighted Leq sound level measured during the night period of 23:00 hours to 07:00 hours.
Measurement time interval, T_m	total time over which measurements are taken. *Note: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.*
Rating level, $L_{Ar,\ Tr}$	specific sound level plus any adjustment for the characteristic features of the sound.
Reference time interval, T_r	specified interval over which the specific sound level is determined. *Note: This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h*
Residual sound	ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Residual sound level, L_r = $L_{Aeq,T}$	equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.
Specific sound level, L_s = $L_{Aeq,Tr}$	equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
Specific sound source	sound source being assessed.
Night-Time	An 8 hour period between 23:00 – 07:00 hours, as per NG4
Noise Ambient	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far. Also see ambient sound.
Noise Background	The steady existing noise level present without contribution from any intermittent sources, The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, 'T' ($L_{AF90,T}$). Also see background sound level, $L_{A90,\ T}$.
Noise Specific	The sound arising from the source under investigation, disregarding all external and residual sources. Also see specific sound source.
NSR	Noise Sensitive Receptor - an identified dwelling, amenity area, recreational zone or other such place where a change in noise may result in a nuisance impact.
RMS	Root Mean Squared, mathematical method to account for swells and troughs within wave forms, such as sound.

Sound Power Level (L_W)	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m2. Utilised to express the intensity at source of a noise emission.
Sound Pressure Level (L_P)	Fluctuations in air pressure caused by the passage of a sound wave. The measurement of sound/noise through the use of a sound level meter, is a representation of these fluctuations in air pressure as they pass the instrument microphone.
Time Weighting	One of the averaging time for noise monitoring instrumentation: F – Fast, instrument samples every 125 milliseconds; S – Slow, instrument samples every 1 second; I – Impulsive, instrument samples every 35 milliseconds.

Note:

Unless otherwise stated all broadband noise values are A-weighted with a fast response.

Where 0dB is referenced it refers to the threshold of hearing – $2x10^{-5}$Pa.

All 1/3 octave values are unweighted/linear. (z-weighted on the Bruel and Kjaer software)

APPENDIX 11-2

APPENDIX 11-2-1

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Moving source, for method Industrial noise - ISO 9613

Name	Desc.	ISO H	ISO Terr.	HDef.	Weighting	Flow(D)	Flow(E)	Flow(N)	Avg.speed	Max.dist.	Lw 31	Lw 63	Lw 125	Lw 250	Lw 500	Lw 1k
Dump Truck	Out C2.31	0.75	--	Relative	A	25	--	--	15	25.00	0.00	87.80	90.90	98.40	103.80	107.00
Dump Truck	In C2.30	0.75	--	Relative	A	25	--	--	15	25.00	0.00	86.80	85.90	97.40	97.80	101.00
HGVs	Trucks out C2.30	0.75	--	Relative	A	80	--	--	15	25.00	0.00	86.80	85.90	97.40	97.80	101.00
HGVs	Trucks in C2.31	0.75	--	Relative	A	80	--	--	15	25.00	0.00	87.80	90.90	98.40	103.80	107.00

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Moving source, for method Industrial noise - ISO 9613

Name	Lw 2k	Lw 4k	Lw 8k	Red 31	Red 63	Red 125	Red 250	Red 500	Red 1k	Red 2k	Red 4k	Red 8k
Dump Truck	113.20	98.00	86.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	103.20	96.00	89.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HGVs	103.20	96.00	89.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HGVs	113.20	98.00	86.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Point sources, for method Industrial noise - ISO 9613

Name	Desc.	Height	Terrain L	HDef.	Type	DI	DI_Horz	DI_Vert	DI(0)	DI(10)	DI(20)	DI(30)	DI(40)	DI(50)	DI(60)	DI(70)
Drilling	Drilling Rig	2.00	81.92	Relative	Normal point source	none	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Screening	Screen stockpiler C10.14	2.00	93.05	Relative	Normal point source	none	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crushing	Tracked mobile plant C9.14	2.00	93.00	Relative	Normal point source	none	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Point sources, for method Industrial noise - ISO 9613

Name	DI(80)	DI(90)	DI(100)	DI(110)	DI(120)	DI(130)	DI(140)	DI(150)	DI(160)	DI(170)	DI(180)	Ca(D)	Ca(E)	Ca(N)	Weighting	No refl.	No building	No ind.site
Drilling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	--	--	A	No	No	No
Screening	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	A	No	No	No
Crushing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	A	No	No	No

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Point sources, for method Industrial noise - ISO 9613

Name	Lw 31	Lw 63	Lw 125	Lw 250	Lw 500	Lw 1k	Lw 2k	Lw 4k	Lw 8k	Red 31	Red 63	Red 125	Red 250	Red 500	Red 1k	Red 2k	Red 4k	Red 8k
Drilling	0.00	87.80	103.90	104.40	112.80	112.00	112.20	107.00	103.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Screening	0.00	94.80	97.90	98.40	102.80	103.00	100.20	98.00	88.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crushing	0.00	92.80	102.90	107.40	111.80	113.00	112.20	107.00	94.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Inputs - Sources and Receivers Historic

Model: Historic Situation
version of Area - Area
Group: (main group)
Listing of: Receivers, for method Industrial noise - ISO 9613

Name	Desc.	Terrain L	HDef.	Height A	Height B	Height C	Height D	Height E	Height F	Façade
NM1	Rx	110.31	Relative	1.50	--	--	--	--	--	No
NM2	Rx	88.74	Relative	1.50	--	--	--	--	--	No
NM3	Rx	89.90	Relative	1.50	--	--	--	--	--	No
NM4	Rx	121.66	Relative	1.50	--	--	--	--	--	No
NSR01		88.90	Relative	1.50	4.00	--	--	--	--	No
NSR02		107.40	Relative	1.50	4.00	--	--	--	--	No
NSR03		125.69	Relative	1.50	4.00	--	--	--	--	No
NSR04		117.85	Relative	1.50	4.00	--	--	--	--	No
NSR05		121.53	Relative	1.50	4.00	--	--	--	--	No
NSR06		116.99	Relative	1.50	4.00	--	--	--	--	No
NSR07		95.00	Relative	1.50	4.00	--	--	--	--	No
NSR08		90.55	Relative	1.50	4.00	--	--	--	--	No

APPENDIX 11-2-2

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Area sources, for method Industrial noise - ISO 9613

Name	Desc.	Height	Terrain L	HDef.	InputLw	Weighting	Ca(D)	Ca(E)	Ca(N)	DeltaL	DeltaH	Ign.Obj.	DI	DI_Horz	DI_Vert
SP1	Rolling cylinder machinery	2.00	94.00	Relative	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0
SP2	Dryer	2.00	94.46	Relative	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0
SP3	Asphalt Plant	2.00	93.33	Relative	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0
SP4	North of crusher	2.00	91.46	Relative	True	Z	0.00	--	--	50.0	50.0	Yes	none	0	0
SP5/SP6	South of Crusher	2.00	91.49	Relative	True	Z	0.00	--	--	50.0	50.0	Yes	none	0	0
SP7	Concrete plant compressor	0.50	90.01	Relative to Objects	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0
SP8	Concrete plant conveyor belt	2.00	90.12	Relative	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0
SP9	Gate entrance to concrete plant.	2.00	101.50	Relative	True	Z	0.00	0.00	0.00	50.0	50.0	Yes	none	0	0

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Area sources, for method Industrial noise - ISO 9613

Name	DI(0)	DI(10)	DI(20)	DI(30)	DI(40)	DI(50)	DI(60)	DI(70)	DI(80)	DI(90)	DI(100)	DI(110)	DI(120)	DI(130)	DI(140)	DI(150)	DI(160)	DI(170)	DI(180)	LwM2 31
SP1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP5/SP6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
SP9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Area sources, for method Industrial noise - ISO 9613

Name	LwM2 63	LwM2 125	LwM2 250	LwM2 500	LwM2 1k	LwM2 2k	LwM2 4k	LwM2 8k	Lw 31	Lw 63	Lw 125	Lw 250	Lw 500	Lw 1k	Lw 2k	Lw 4k	Lw 8k	Red 31
SP1	84.77	82.77	83.77	84.77	81.77	78.77	73.77	67.77	--	98.00	96.00	97.00	98.00	95.00	92.00	87.00	81.00	0.00
SP2	98.77	83.77	85.77	85.77	81.77	80.77	77.77	70.77	--	112.00	97.00	99.00	99.00	95.00	94.00	91.00	84.00	0.00
SP3	89.57	74.57	74.57	74.57	73.57	77.57	82.57	84.57	--	102.00	87.00	87.00	87.00	86.00	90.00	95.00	97.00	0.00
SP4	81.29	79.29	80.29	80.29	78.29	79.29	76.29	67.29	--	97.00	95.00	96.00	96.00	94.00	95.00	92.00	83.00	0.00
SP5/SP6	104.05	96.05	99.05	97.05	93.05	90.05	87.05	80.05	--	117.00	109.00	112.00	110.00	106.00	103.00	100.00	93.00	0.00
SP7	73.02	75.02	81.02	73.02	70.02	67.02	61.02	54.02	--	87.00	89.00	95.00	87.00	84.00	81.00	75.00	68.00	0.00
SP8	74.86	75.86	76.86	73.86	69.86	64.86	59.86	60.86	--	85.00	86.00	87.00	84.00	80.00	75.00	70.00	71.00	0.00
SP9	88.45	80.45	90.45	80.45	74.45	71.45	65.45	58.45	--	99.00	91.00	101.00	91.00	85.00	82.00	76.00	69.00	0.00

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Area sources, for method Industrial noise - ISO 9613

Name	Red 63	Red 125	Red 250	Red 500	Red 1k	Red 2k	Red 4k	Red 8k
SP1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP5/SP6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SP9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Moving source, for method Industrial noise - ISO 9613

Name	Desc.	ISO H	ISO Terr.	HDef.	Weighting	Flow(D)	Flow(E)	Flow(N)	Avg.speed	Max.dist.	Lw 31	Lw 63	Lw 125	Lw 250	Lw 500	Lw 1k	Lw 2k
HGVs	Trucks out C2.30	0.75	--	Relative	A	140	--	--	15	25.00	0.00	86.80	85.90	97.40	97.80	101.00	103.20
HGVs	Trucks in C2.31	0.75	--	Relative	A	140	--	--	15	25.00	0.00	87.80	90.90	98.40	103.80	107.00	113.20

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Moving source, for method Industrial noise - ISO 9613

Name	Lw 4k	Lw 8k	Red 31	Red 63	Red 125	Red 250	Red 500	Red 1k	Red 2k	Red 4k	Red 8k
HGVs	96.00	89.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HGVs	98.00	86.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Input - Sources and Receivers Currently

Model: Currently Situation
version of Area - Area
Group: (main group)
Listing of: Receivers, for method Industrial noise - ISO 9613

Name	Desc.	Terrain L	HDef.	Height A	Height B	Height C	Height D	Height E	Height F	Façade
SP1	Rx	94.10	Relative	1.50	--	--	--	--	--	No
SP2	Rx	94.03	Relative	1.50	--	--	--	--	--	No
SP3	Rx	93.30	Relative	1.50	--	--	--	--	--	No
SP4	Rx	91.71	Relative	1.50	--	--	--	--	--	No
SP5	Rx	91.68	Relative	1.50	--	--	--	--	--	No
SP6	Rx	91.58	Relative	1.50	--	--	--	--	--	No
SP7	Rx	90.00	Relative	1.50	--	--	--	--	--	No
SP8	Rx	90.02	Relative	1.50	--	--	--	--	--	No
SP9	Rx	102.19	Relative	1.50	--	--	--	--	--	No
NM1	Rx	110.31	Relative	1.50	--	--	--	--	--	No
NM2	Rx	88.74	Relative	1.50	--	--	--	--	--	No
NM3	Rx	89.90	Relative	1.50	--	--	--	--	--	No
NM4	Rx	121.66	Relative	1.50	--	--	--	--	--	No
NSR01		88.90	Relative	1.50	4.00	--	--	--	--	No
NSR02		107.40	Relative	1.50	4.00	--	--	--	--	No
NSR03		125.69	Relative	1.50	4.00	--	--	--	--	No
NSR04		117.85	Relative	1.50	4.00	--	--	--	--	No
NSR05		121.53	Relative	1.50	4.00	--	--	--	--	No
NSR06		116.99	Relative	1.50	4.00	--	--	--	--	No
NSR07		95.00	Relative	1.50	4.00	--	--	--	--	No
NSR08		90.55	Relative	1.50	4.00	--	--	--	--	No

APPENDIX 11-2-3

Report: Table of Results
Model: Currently Situation
LAeq: total results for receivers
Group: (main group)
Group Reduction: No

Name Receiver	Description	X	Y	Height	Day	Evening	Night
NM1_A	Rx	190698.80	367550.53	1.50	48.6	36.9	36.9
NM2_A	Rx	191045.61	367144.65	1.50	68.6	24.9	24.9
NM3_A	Rx	191164.50	367474.94	1.50	43.8	25.9	25.9
NM4_A	Rx	190260.59	367523.47	1.50	28.4	18.7	18.7
NSR01_A		191183.22	367466.03	1.50	44.3	25.9	25.9
NSR01_B		191183.22	367466.03	4.00	45.3	26.9	26.9
NSR02_A		190716.69	367575.64	1.50	38.1	29.1	29.1
NSR02_B		190716.69	367575.64	4.00	45.1	34.9	34.9
NSR03_A		190256.72	367479.88	1.50	24.3	15.9	15.9
NSR03_B		190256.72	367479.88	4.00	27.8	19.2	19.2
NSR04_A		190093.61	367363.03	1.50	23.9	14.0	14.0
NSR04_B		190093.61	367363.03	4.00	27.1	15.8	15.8
NSR05_A		190108.70	367265.69	1.50	26.5	19.3	19.3
NSR05_B		190108.70	367265.69	4.00	28.3	20.8	20.8
NSR06_A		190298.10	366848.01	1.50	36.8	27.0	27.0
NSR06_B		190298.10	366848.01	4.00	37.7	27.9	27.9
NSR07_A		190859.64	367043.84	1.50	46.7	34.6	34.6
NSR07_B		190859.64	367043.84	4.00	47.4	36.1	36.1
NSR08_A		190966.06	367078.04	1.50	53.1	31.8	31.8
NSR08_B		190966.06	367078.04	4.00	54.4	32.8	32.8
SP1_A	Rx	190840.83	367403.64	1.50	79.5	79.4	79.4
SP2_A	Rx	190842.09	367400.68	1.50	78.7	78.7	78.7
SP3_A	Rx	190822.98	367376.60	1.50	75.8	75.4	75.4
SP4_A	Rx	190843.98	367338.82	1.50	79.9	57.7	57.7
SP5_A	Rx	190859.35	367327.22	1.50	87.4	54.4	54.4
SP6_A	Rx	190858.17	367325.01	1.50	86.4	54.1	54.1
SP7_A	Rx	190739.54	367499.50	1.50	68.6	68.6	68.6
SP8_A	Rx	190747.18	367512.76	1.50	69.6	69.6	69.6
SP9_A	Rx	190843.64	367429.57	1.50	88.8	69.9	69.9

All shown dB values are A-weighted

APPENDIX 11-2-4

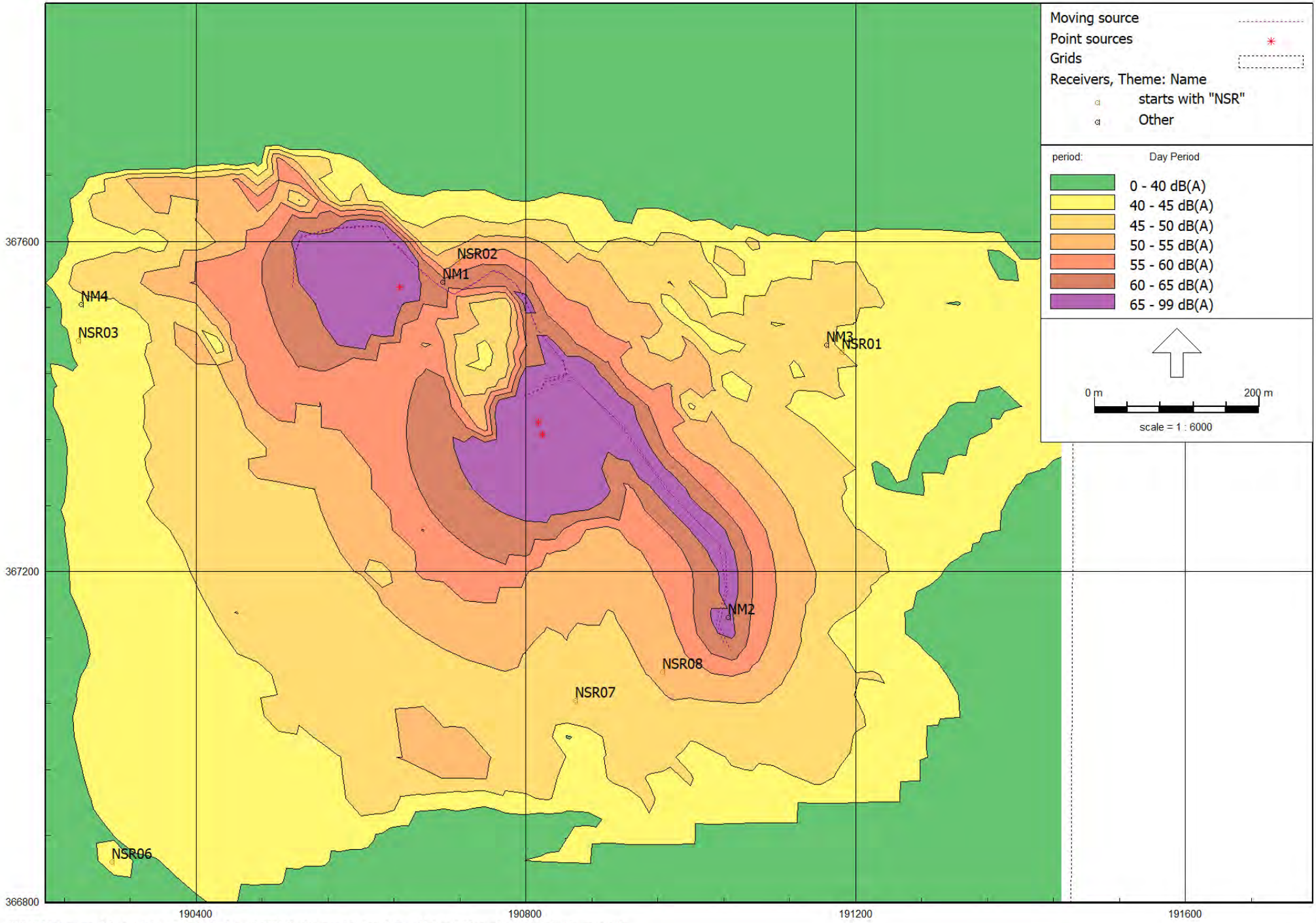
E2321
Results Historic

Report: Table of Results
Model: Historic Situation
LAeq: total results for receivers
Group: (main group)
Group Reduction: No

Name Receiver	Description	X	Y	Height	Day	Evening	Night
NM1_A	Rx	190698.80	367550.53	1.50	63.5	55.8	55.8
NM2_A	Rx	191045.61	367144.65	1.50	66.2	38.8	38.8
NM3_A	Rx	191164.50	367474.94	1.50	46.0	44.1	44.1
NM4_A	Rx	190260.59	367523.47	1.50	38.1	32.7	32.7
NSR01_A		191183.22	367466.03	1.50	45.7	43.2	43.2
NSR01_B		191183.22	367466.03	4.00	47.4	45.4	45.4
NSR02_A		190716.69	367575.64	1.50	47.4	43.5	43.5
NSR02_B		190716.69	367575.64	4.00	52.5	50.7	50.7
NSR03_A		190256.72	367479.88	1.50	38.3	29.5	29.5
NSR03_B		190256.72	367479.88	4.00	41.2	32.9	32.9
NSR04_A		190093.61	367363.03	1.50	29.9	27.2	27.2
NSR04_B		190093.61	367363.03	4.00	31.7	29.4	29.4
NSR05_A		190108.70	367265.69	1.50	31.4	30.0	30.0
NSR05_B		190108.70	367265.69	4.00	33.0	31.6	31.6
NSR06_A		190298.10	366848.01	1.50	41.5	41.1	41.1
NSR06_B		190298.10	366848.01	4.00	42.2	41.7	41.7
NSR07_A		190859.64	367043.84	1.50	49.2	47.8	47.8
NSR07_B		190859.64	367043.84	4.00	50.5	49.3	49.3
NSR08_A		190966.06	367078.04	1.50	51.5	44.0	44.0
NSR08_B		190966.06	367078.04	4.00	52.9	45.4	45.4

All shown dB values are A-weighted

APPENDIX 11-2-5



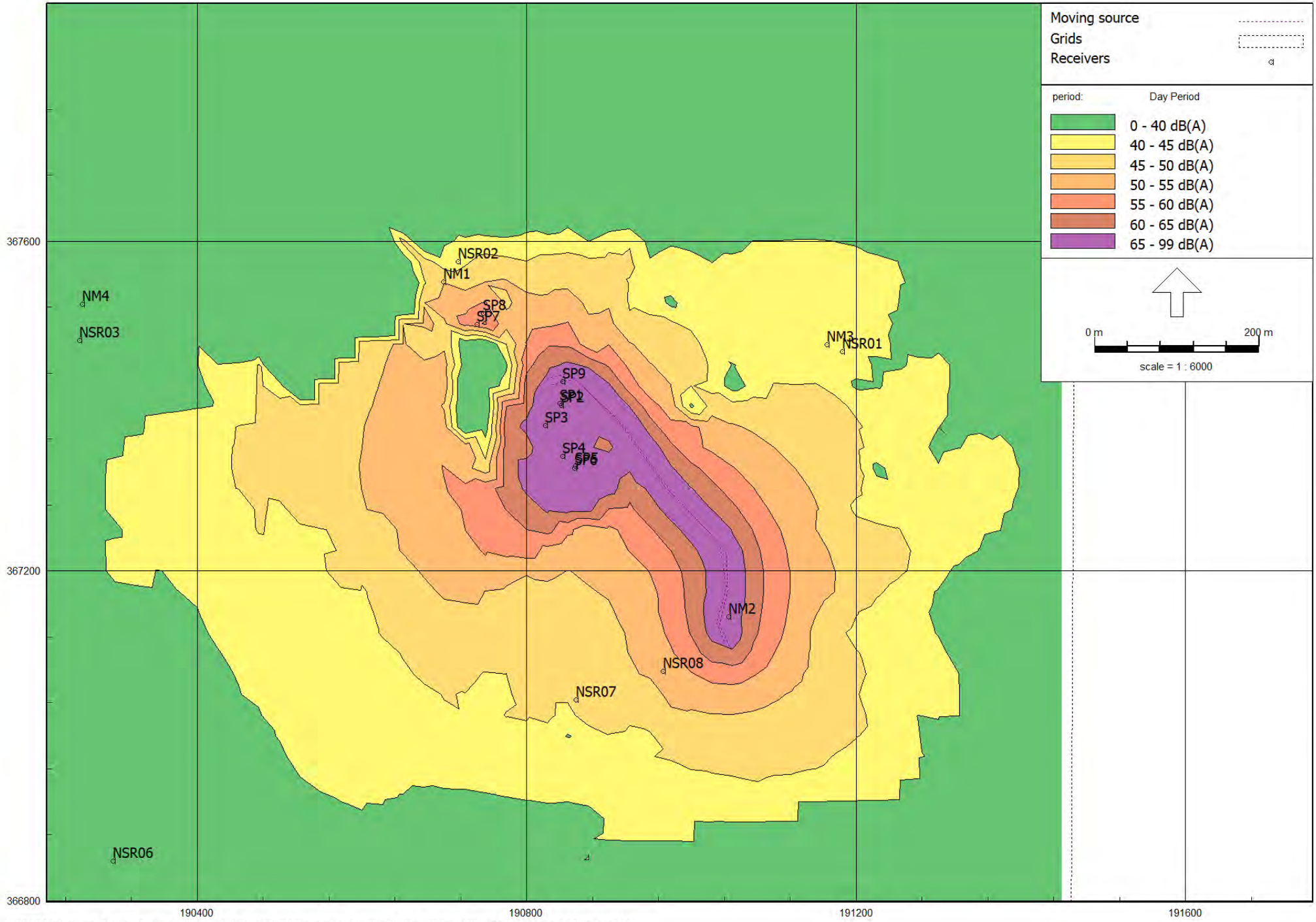
Historic Situation - Lday

9 Jan 2025, 14:09

Kerri Nolan - Malone O'Regan Environmental Services Ltd

ISO 9613, [version of Area - Historic Situation] , iNoise V2024 Pro Licensed to Kerri Nolan - Malone O'Regan Environmental Services Ltd

APPENDIX 11-2-6



Currently Situation - Lday

9 Jan 2025, 14:17

Kerri Nolan - Malone O'Regan Environmental Services Ltd

ISO 9613, [version of Area - Currently Situation] , iNoise V2024 Pro Licensed to Kerri Nolan - Malone O'Regan Environmental Services Ltd

APPENDIX 11-3

APPENDIX 11-3-1

Daily Data

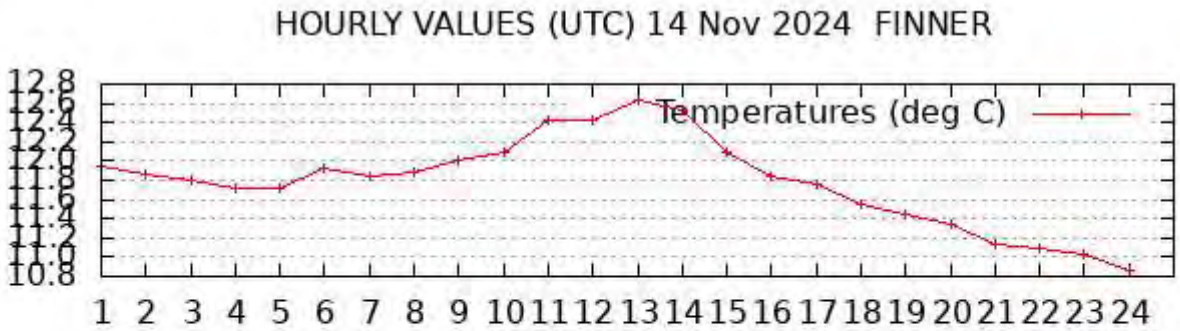
Weather station Data is available from 16/10/2015 to 11/12/2024

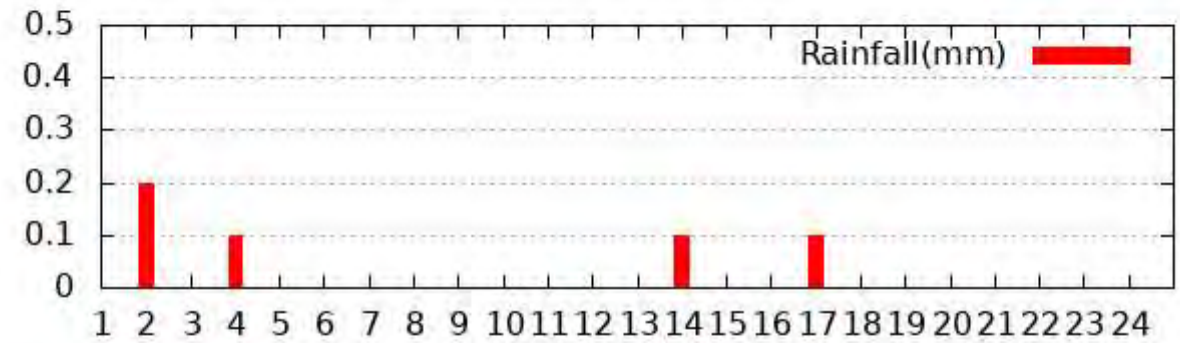
Select Station & Date: Station Finner Camp Date 14/11/2024

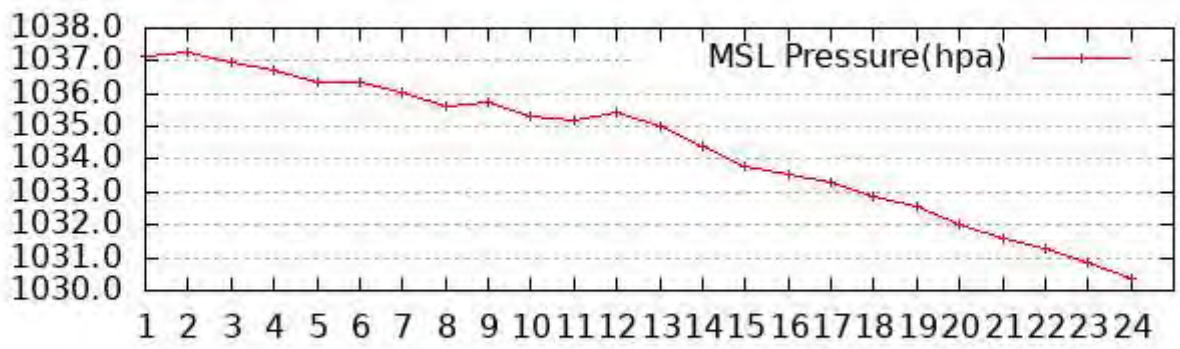
Go

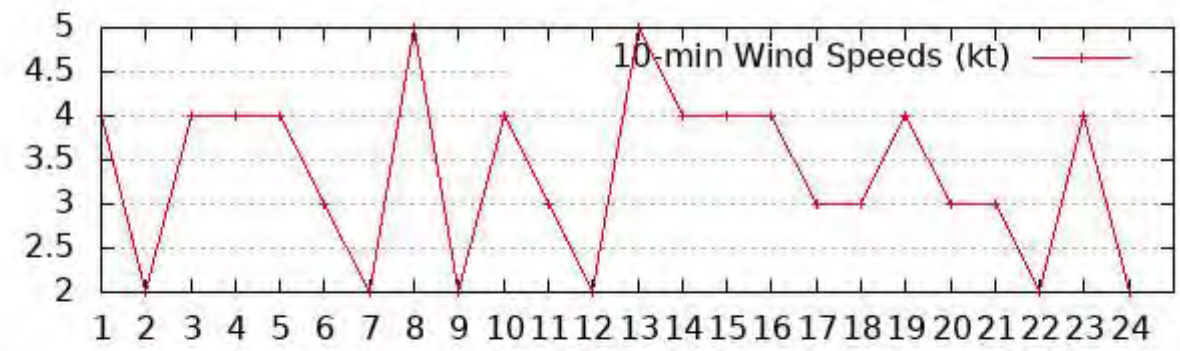
Weather Station Reports from Finner Camp

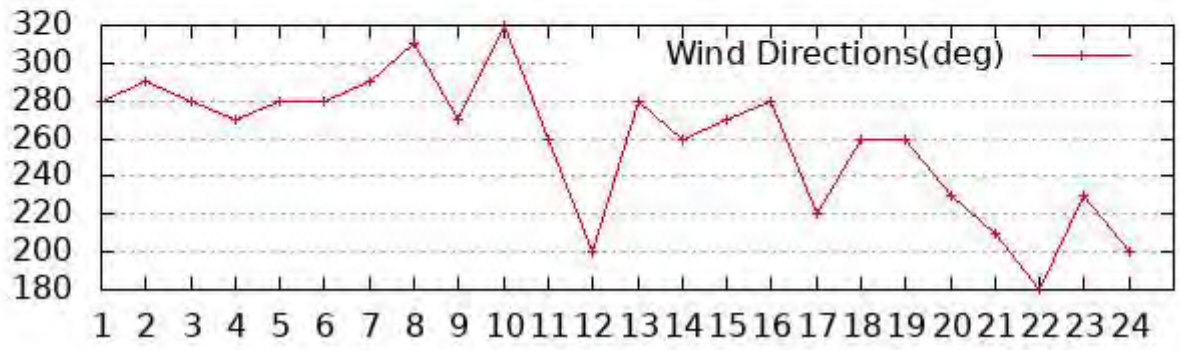
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Max Gust (>= 34 knots)	Sunshine (hours)
14/11/2024	0.5	12.7	10.9	10.7	3.6		











Daily Data

Climate

Climate of Ireland

Climate Change

Weather Extreme Records for Ireland

Major Weather Events

Summer Centre

Storm Centre

Past Weather Statements

Services

NFCS

Weather Observations Website WOW-IE

Available Data

What we measure

APPENDIX 11-3-2

Daily Data

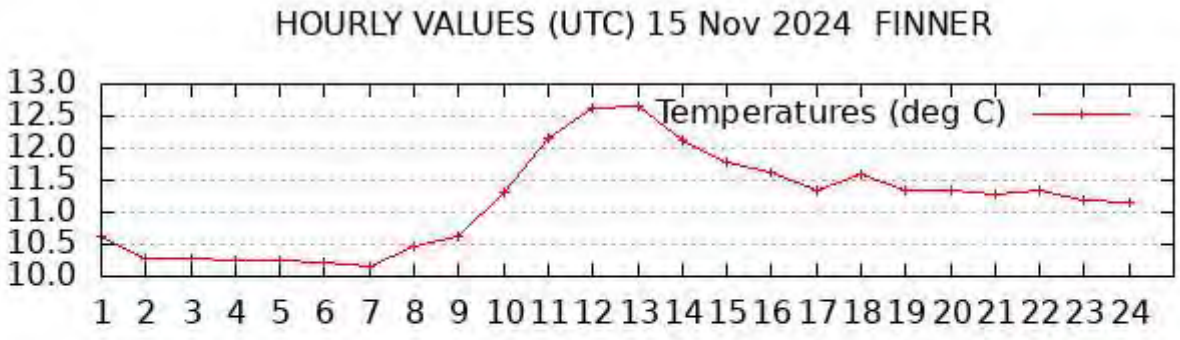
Weather station Data is available from 16/10/2015 to 11/12/2024

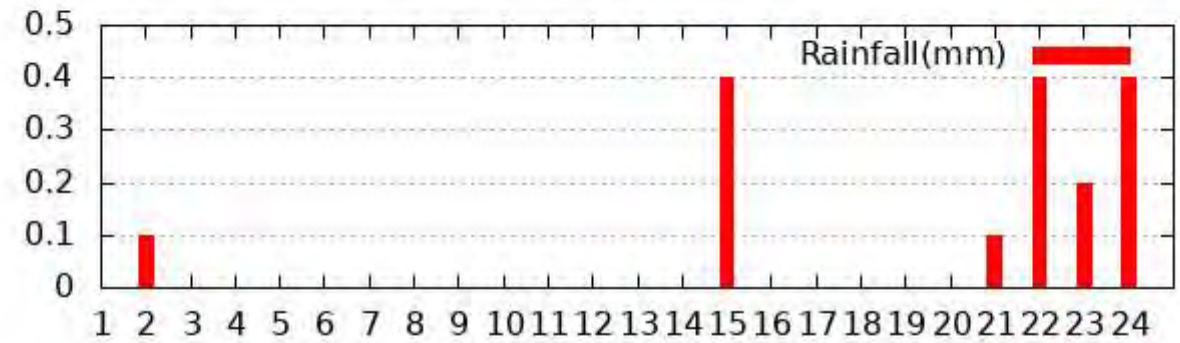
Select Station & Date: Station Finner Camp Date 15/11/2024

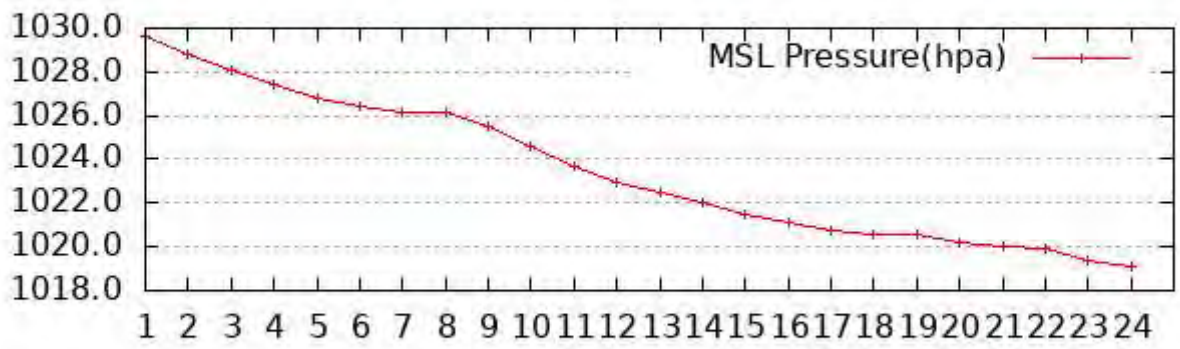
Go

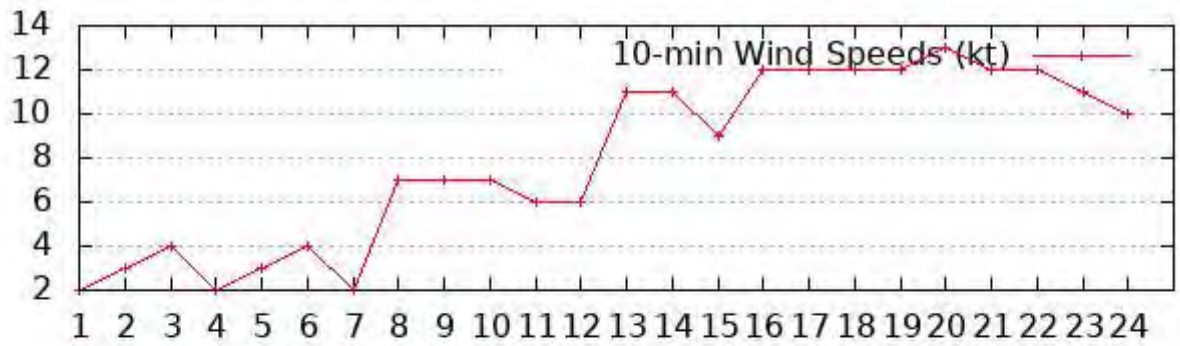
Weather Station Reports from Finner Camp

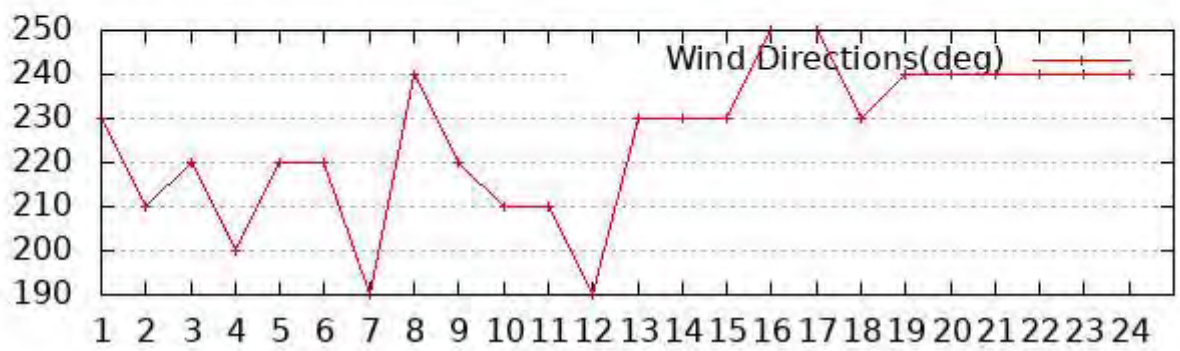
Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Max Gust (>= 34 knots)	Sunshine (hours)
15/11/2024	1.6	13.2	10.0	9.4	7.8		











Daily Data

Climate

Climate of Ireland

Climate Change

Weather Extreme Records for Ireland

Major Weather Events

Summer Centre

Storm Centre

Past Weather Statements

Services

NFCS

Weather Observations Website WOW-IE

Available Data

What we measure

APPENDIX 11-4

NOISE CHARTS AND PLATES

Table of Contents

Introduction 1

Calibration of Sound Level Meter 1

NM1 2

NM2 4

NM3 6

NM4 8

Table of Tables

Table 1: Calibration of the Sound Level Meter 1

Table of Plates

Plate 1: NM1 Location 2
Plate 2: NM2 Location 4
Plate 3: NM3 Location 6
Plate 4: NM4 Location 8

Table of Charts

Chart 1: NM1 Run 1 Day 1/3 Octave Frequency Analysis 2
Chart 2: NM1 Run 2 Day 1/3 Octave Frequency Analysis 3
Chart 5: NM1 Night Run 1 1/3 Octave Frequency Analysis 3
Chart 6: NM1 Night Run 2 1/3 Octave Frequency Analysis 3
Chart 7: NM2 Run 1 Day 1/3 Octave Frequency Analysis 4
Chart 8: NM2 Run 2 Day 1/3 Octave Frequency Analysis 5
Chart 11: NM2 Night Run 1 1/3 Octave Frequency Analysis 5
Chart 12: NM2 Night Run 2 1/3 Octave Frequency Analysis 5
Chart 13- NM3 Run 1 Day 1/3 Octave Frequency Analysis 6
Chart 14: NM3 Run 2 Day 1/3 Octave Frequency Analysis 7
Chart 17: NM3 Run 1 Night 1/3 Octave Frequency Analysis 7
Chart 18: NM3 Run 2 Night 1/3 Octave Frequency Analysis 7
Chart 19: NM4 Run 1 Day 1/3 Octave Frequency Analysis 8
Chart 20: NM4 Run 2 Day 1/3 Octave Frequency Analysis 9
Chart 23: NM4 Night Run 1 1/3 Octave Frequency Analysis 9
Chart 24: NM4 Night Run 2 1/3 Octave Frequency Analysis 9

Appendix

INTRODUCTION

This document supplies the Frequency Analysis Charts for each monitoring event.

CALIBRATION OF SOUND LEVEL METER

The sound level meter used was an NTI XL2 Audio Acoustic Hand-held Analyser sound level meter (SLM).

The SLM is Type 1 and equipped with Frequency Analysis Software.

The monitoring equipment was calibrated prior to and following the measurement period using a

- Cirrus CR515 calibrator (Serial No. 95601)

Broadband noise levels were measured using the A-weighted network, and a fast-sampling interval, unless otherwise stated.

Table 1: Calibration of the Sound Level Meter

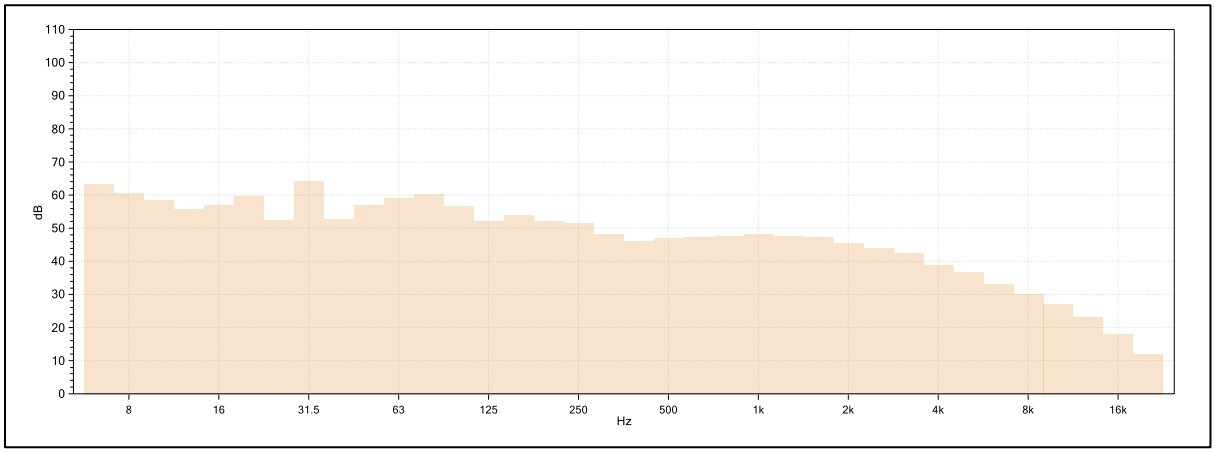
SLM	Serial No.	Calib. Preamp ID No	[Calibration] Calib. Time	[Calibration] Sensitivity	[Calibration] Calibration Input	[Calibration] Calibration Type
NTI XL2	A2A-18871-E0	M2230	14/11/2024 11:13	42.7mV/Pa	TopSocket	External reference

Appendix

NM1

Plate 1: NM1 Location

Chart 1: NM1 Run 1 Day 1/3 Octave Frequency Analysis



Appendix

Chart 2: NM1 Run 2 Day 1/3 Octave Frequency Analysis

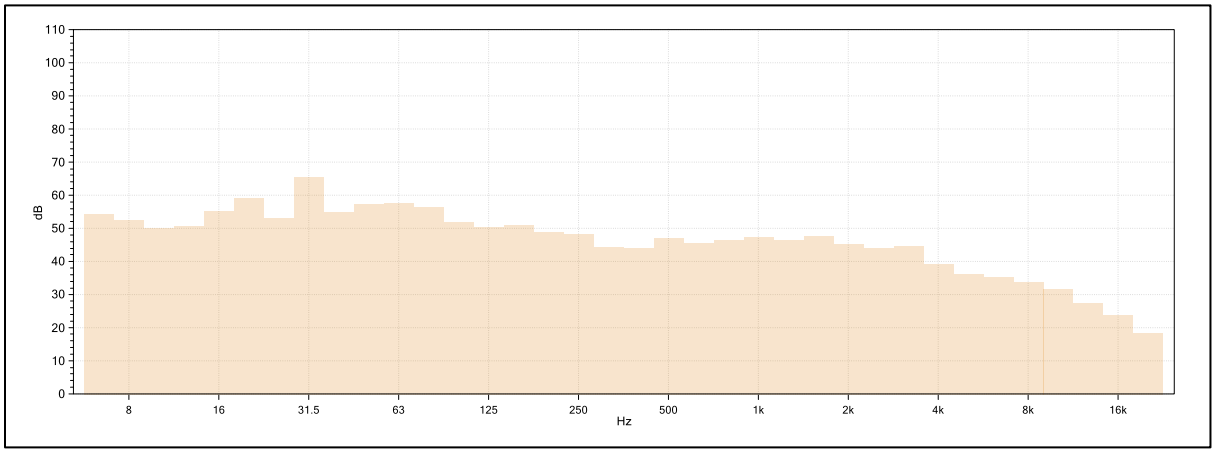


Chart 3: NM1 Night Run 1 1/3 Octave Frequency Analysis

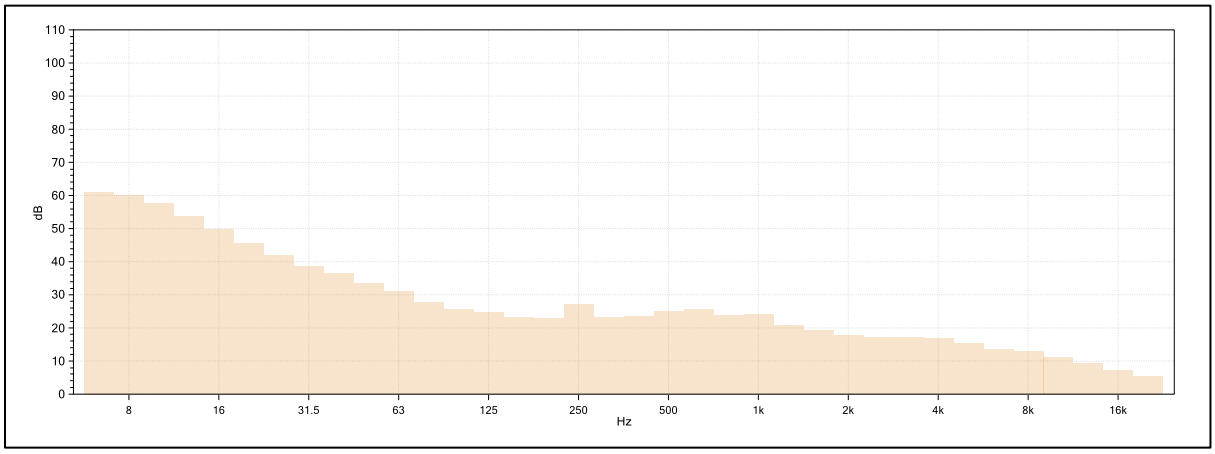
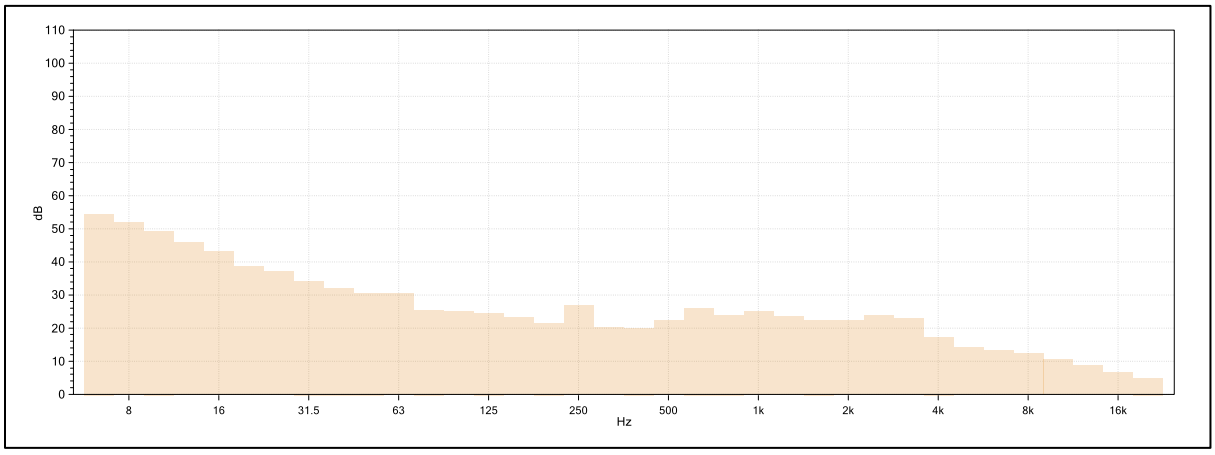


Chart 4: NM1 Night Run 2 1/3 Octave Frequency Analysis

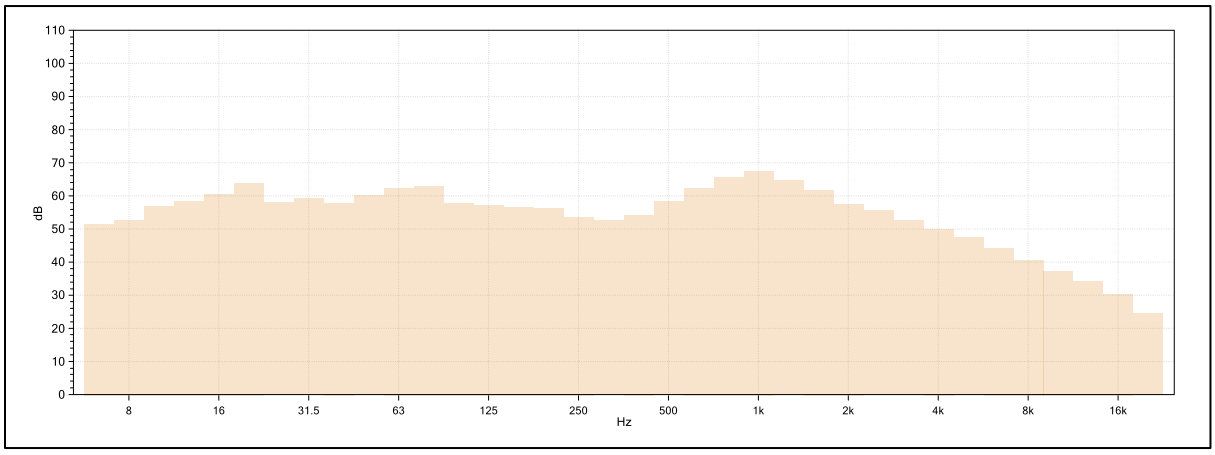


Appendix

NM2

Plate 2: NM2 Location

Chart 5: NM2 Run 1 Day 1/3 Octave Frequency Analysis



Appendix

Chart 6: NM2 Run 2 Day 1/3 Octave Frequency Analysis

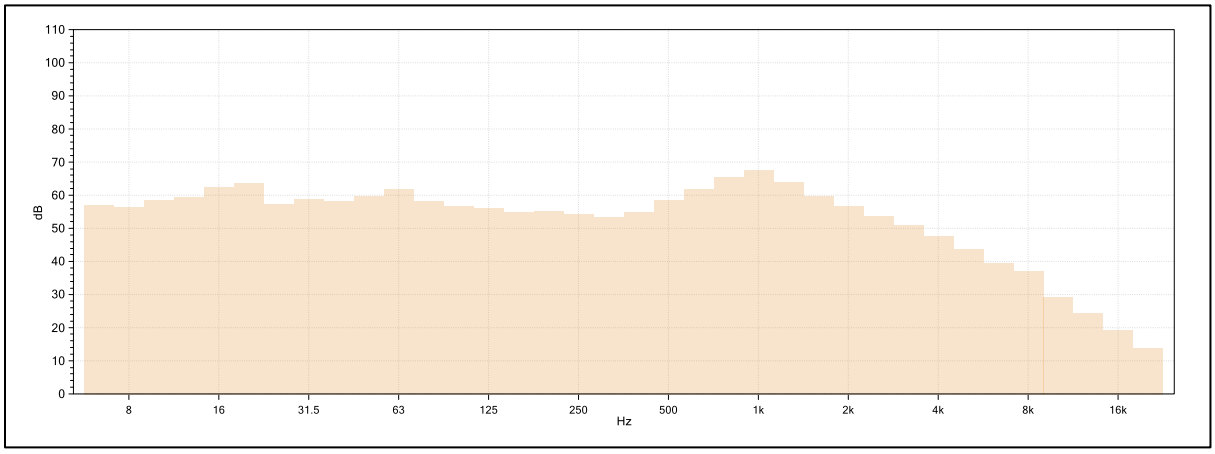


Chart 7: NM2 Night Run 1 1/3 Octave Frequency Analysis

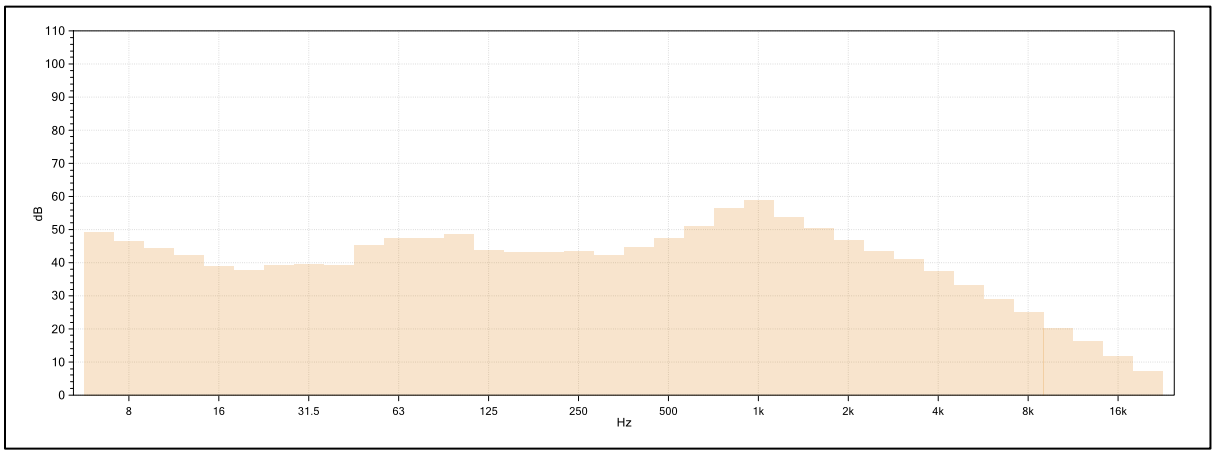
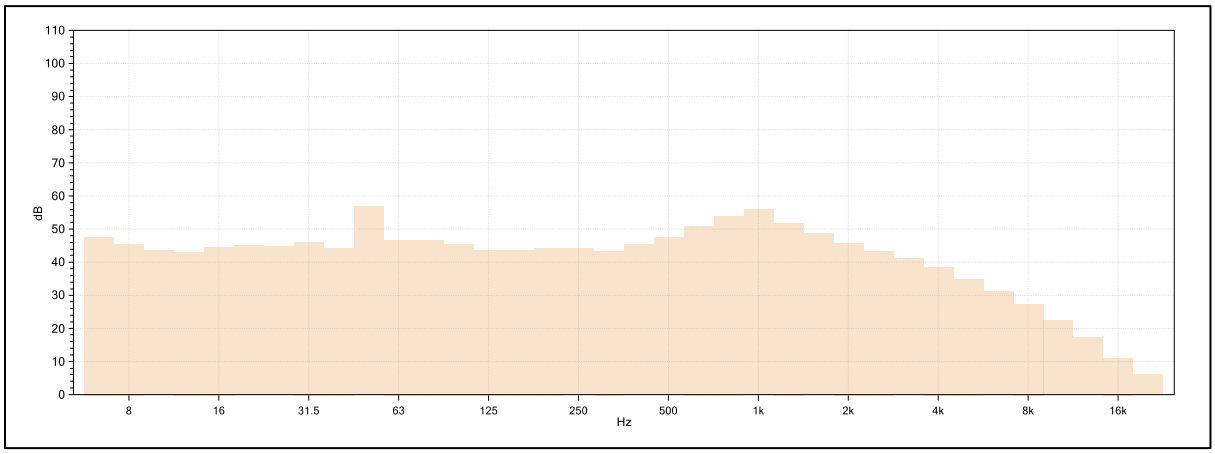


Chart 8: NM2 Night Run 2 1/3 Octave Frequency Analysis

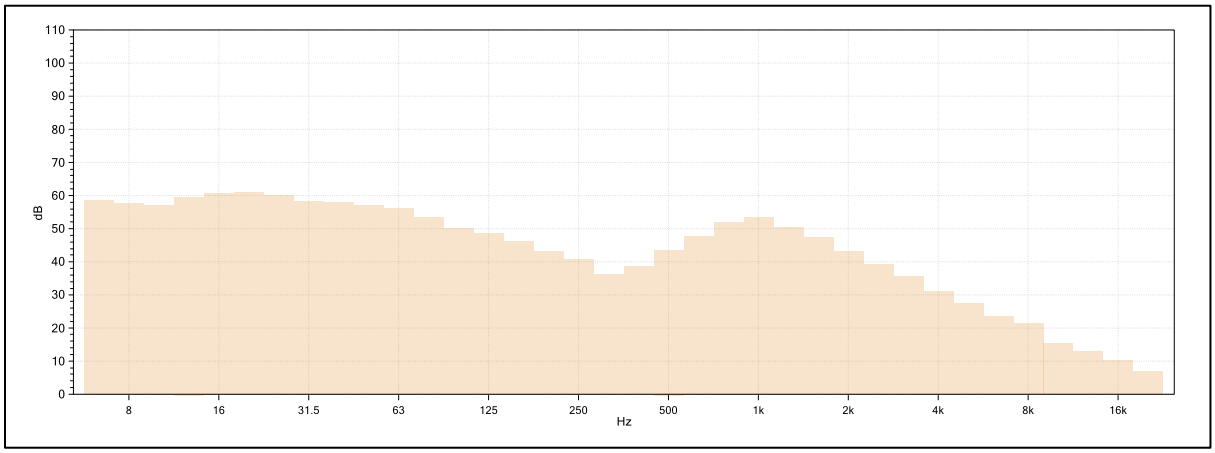


Appendix

NM3

Plate 3: NM3 Location

Chart 9- NM3 Run 1 Day 1/3 Octave Frequency Analysis



Appendix

Chart 10: NM3 Run 2 Day 1/3 Octave Frequency Analysis

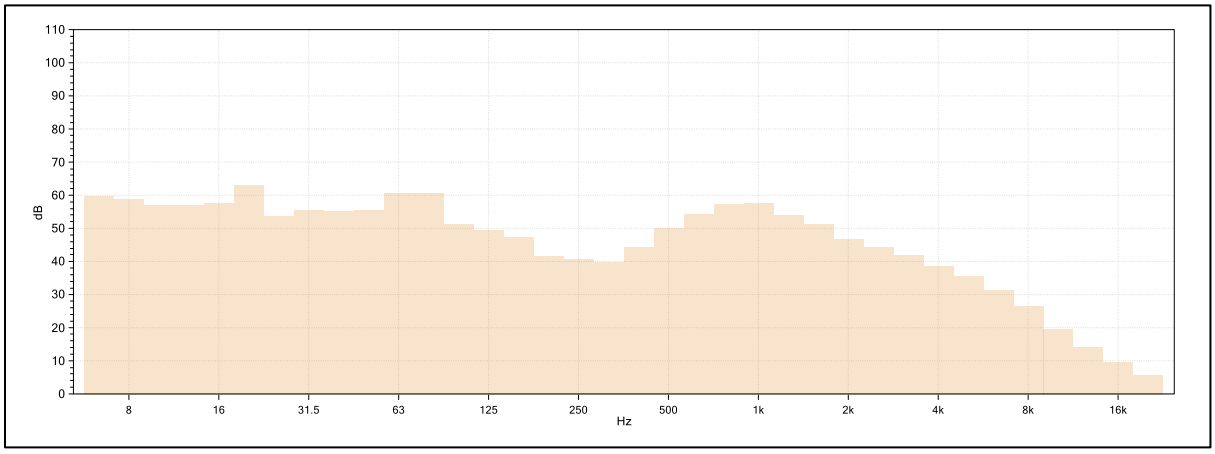


Chart 11: NM3 Run 1 Night 1/3 Octave Frequency Analysis

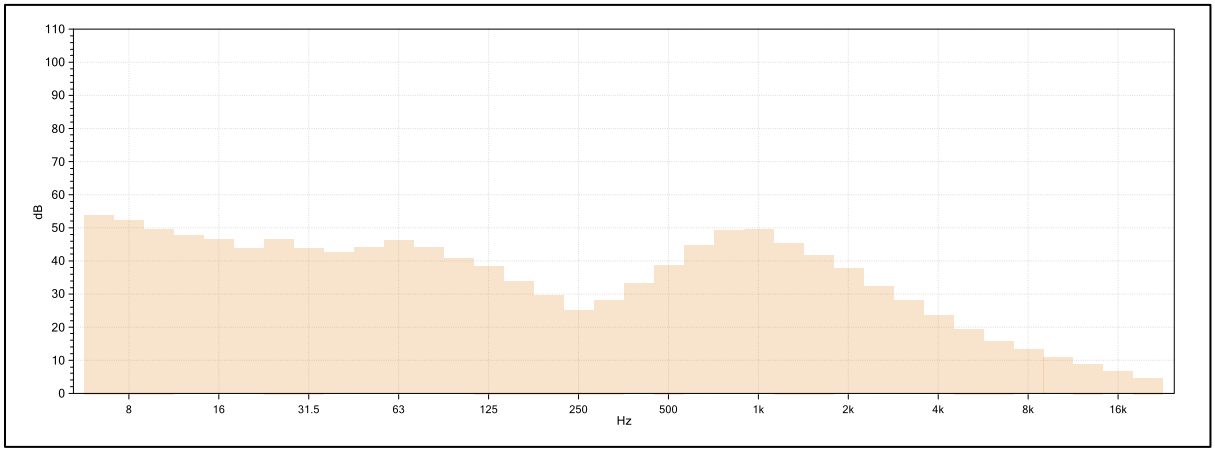
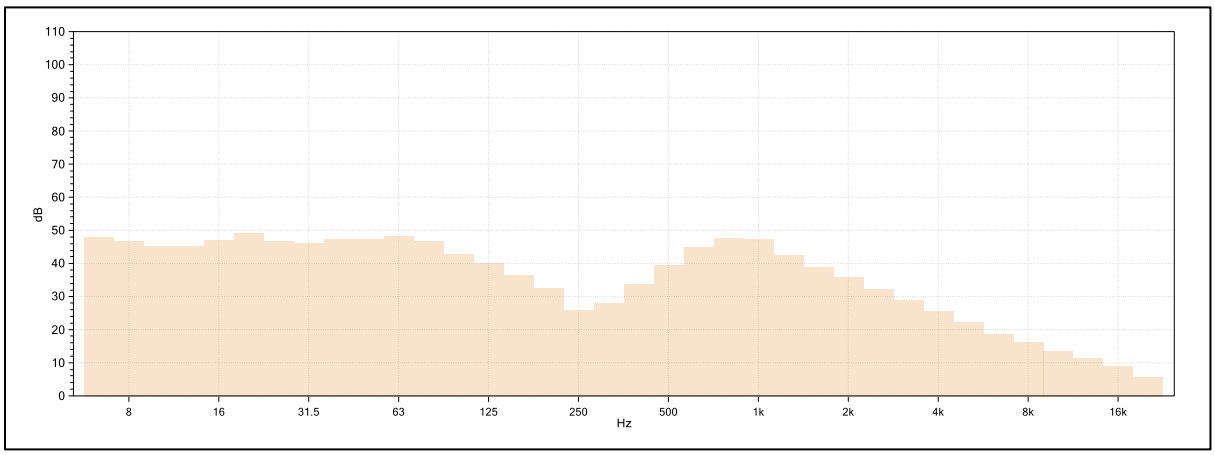


Chart 12: NM3 Run 2 Night 1/3 Octave Frequency Analysis

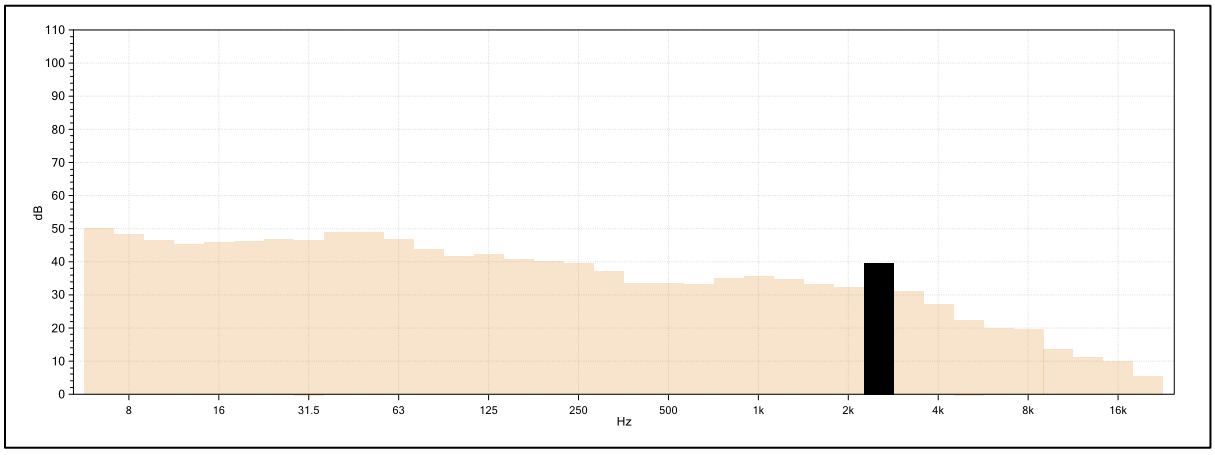


Appendix

NM4

Plate 4: NM4 Location

Chart 13: NM4 Run 1 Day 1/3 Octave Frequency Analysis



An objective tone of 2.5Khz was measured during this measurement associated with a car driving by the SLM.

Appendix

Chart 14: NM4 Run 2 Day 1/3 Octave Frequency Analysis

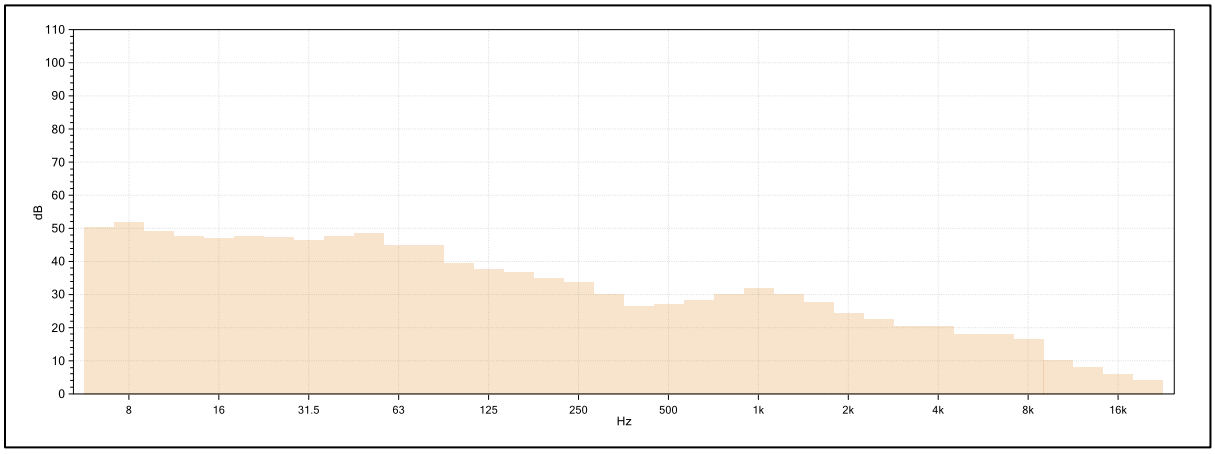


Chart 15: NM4 Night Run 1 1/3 Octave Frequency Analysis

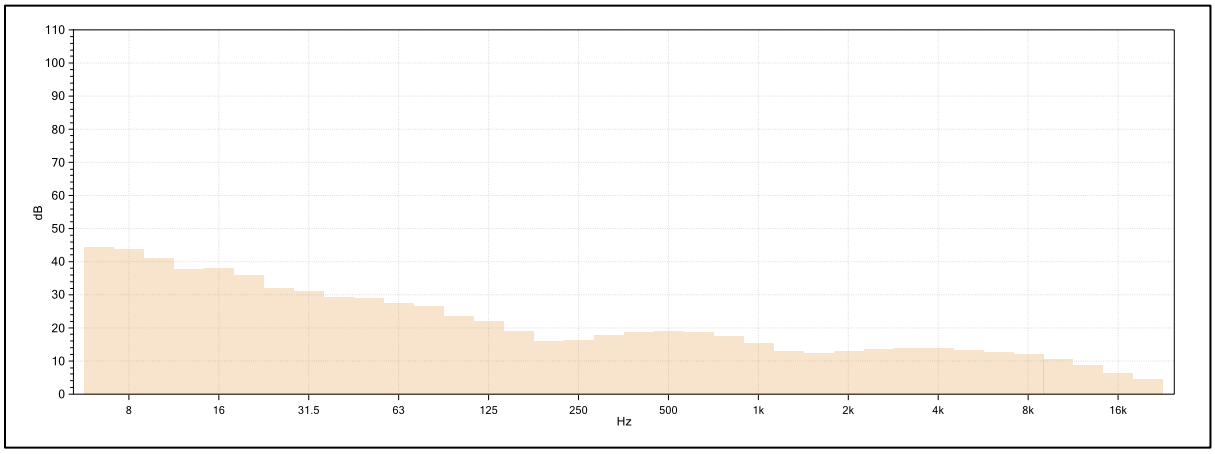
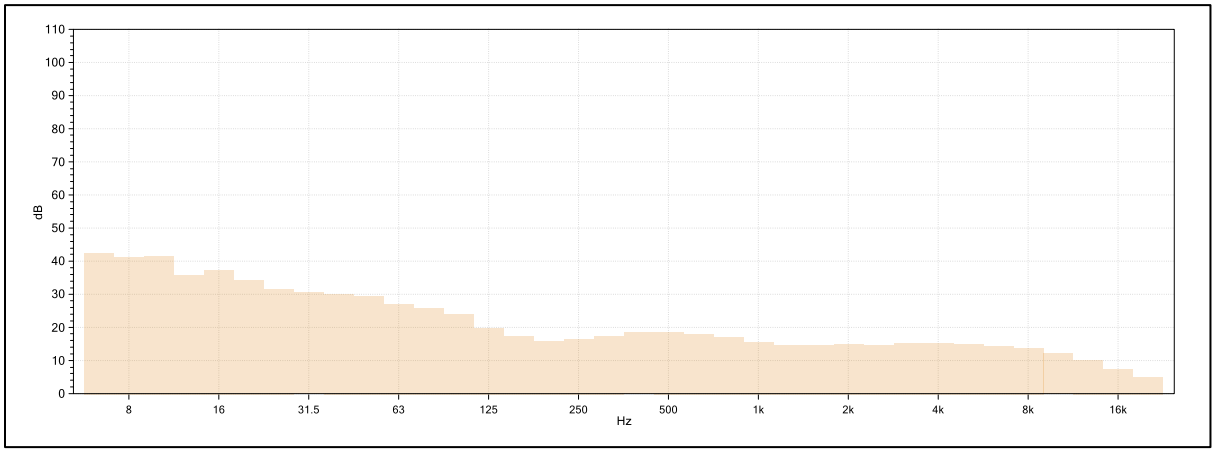


Chart 16: NM4 Night Run 2 1/3 Octave Frequency Analysis



APPENDIX 13

APPENDIX 13-1

APPENDIX 13-1

RECORDED MONUMENTS IN THE STUDY AREA

DG103-017001- Glasbolie Hilltop enclosure

McGonigle's Fort, a massive earthwork, clearly of a defensive nature. The site consists of an oval area (80m E-W; 60m N-S) probably scarped on the N and S sides with an earthen bank at the E and a massive earthen bank 3m to 4m high on the W where the site is most vulnerable. Outside this oval area and below it on the hillside is a massive fosse with an outer earthen bank enclosing the site for most of its circuit. This outer bank has been incorporated into field boundaries and a lane-way, which leads to the site from the S, and it is not clear to what extent it is a primary feature of the site. In the NE sector of the interior there is an earthen mound (DG103-017002-) at a point where there is a change in ground level. The mound is c. 5m high on the E side. The site is located on the E side of a long drumlin-type ridge. It has excellent views in all directions and although set on good land overlooks a boggy valley running in from the sea to the N. Local tradition says that the site is the burial place of a king of Tir Conaill. The site has been claimed as a possible motte-and-bailey but it has been more usually treated as a hillfort. However, the site definitely does not exploit the contours of the summit of the hill, as this is located outside the enclosure a little to the W. The site has been identified with Ard Fothadh mentioned in early Irish sources.

DG103-023--- Ballymagrorty Irish Souterrain

There is no sign visible of the '15 steps leading down to a subterranean passage' recorded here by Davies.

DG103-029--- Lurgan Megalithic tomb – unclassified

Killanin and Duignan refer to a 'chambered cairn' in this townland. The feature is a grass-grown mound c. 15m in diameter and up to 1m high. An OS trigonometrical pillar has been built on the mound. The nature of any structure that the mound may cover is not known.

The mound stands toward the NE edge of an embanked enclosure c. 35m in diameter, and both are within a great D-shaped enclosure measuring c. 340m N-S by c. 200m E-W. This great enclosure is delimited at the E by a steep natural escarpment and elsewhere by the collapsed remains of a stone wall that curves around the top of the hill. It appears to be a hillfort, although it has been suggested that it is a Neolithic enclosure.

DG103-030--- Lurgan Megalithic tomb – court tomb

This monument is not marked on any edition of the OS 6-inch map. It stands in pasture on a W-facing hillslope. The sea is visible to the W beyond low drumlin-like hills, but the rising ground restricts the outlook to the E.

The monument consists of a long unroofed gallery with a narrow end chamber separated from the remainder by a pair of small jambs. The front of the gallery, at the SSE, is incorporated in a field fence. There are slight but ill-defined traces of a mound in the hummocky pasture around the structure. A noticeable dip in the ground, c. 11m beyond the back of the gallery, may represent the end of a long cairn.

The gallery is almost 9m long and, except for the rear chamber, is not now divided. The undivided portion is 2.3-2.5m wide, and the short rear chamber, which is 2m long, narrows from 1.8m wide at its outer end to 1.5m at the back.

The entry to the gallery is between two well-matched, transversely set jambs, 0.5m apart, which support a lintel measuring 1.7m by 0.8m by 0.4m thick. The jambs are partly concealed by the crossing fence. Both are 0.8m high. Immediately inside each jamb is a small set stone. That at the E is possibly split from the jamb. It is 0.55m long, 0.3m thick and 0.2m lower than the jamb. The stone at the W measures 0.15m by at least 0.3m and is the same height as the jamb in front of it.

Four orthostats form each side of the undivided portion of the gallery. The heights of those at the E from S to N are 0.6m, 0.5m, 0.7m and 0.35m. The heights of the stones on the W side from S to N are 0.8m, 0.8m, 0.7m and 0.65m.

The jambs at the entrance to the rear chamber are transversely set and stand 1.1m apart. Both rise just above the present floor of the gallery and are c. 0.3m lower than the adjacent sidestones. A single stone forms each side of the rear chamber, and it is closed by a low backstone. The sidestone at the E, set inside the line of the rest of this side of the gallery, is 0.3m high. The one at the W, skewed slightly so as to narrow the back of the chamber, is also 0.3m high. The backstone is 0.2m high. Approximately 2.8m NW of the back of the gallery is a set stone, 0.8m by 0.55m by 0.45m high, of uncertain status. It is not hatched on the plan.

The original number of chambers in the gallery cannot be determined, but it seems likely that there were at least two chambers between the entrance jambs and the small rear chamber.

DG103-031--- Lurgan Hut site

The 'Hut Site' recorded here (O. Davies) cannot now be traced. It was '16 ft. across' and the 'outer face of the oval was not visible'. The centre was slightly hollow! It was situated in good pasture on the S of Lurgan ridge.

DG103-032--- Lurgan Cairn - unclassified

Internal diam. c. 8m. A small circular area enclosed by an overgrown stone wall surviving up to .7m in height and up to 2.5m in width. Two gaps .5m, in width, occur in the wall one to the N and another to the W. A low ridge of stones and clay runs through the W half of the enclosure. The interior is fairly level but there is a pit 2m × 0.9m and 5m in depth filled with small stones at the centre. Davies recorded a fosse 13ft wide but this is no longer apparent. Situated on Lurgan Ridge in good pasture. There are drops to the S and E. The small size of the monument presents difficulties as to its interpretation. Davies records it as a 'Flattened Cairn'.

DG103-03901- Lurgan Ringfort - Cashel

Internal diam. 35m. A subcircular area enclosed by a collapsed stone wall surviving only 10cms in height. In places the wall is gone but can be traced in the line of the rock outcrop which it originally followed along the ENE side. There are several clearings in the wall collapse

presumably of a recent date. At the NE end are the remains of a cairn (DG103-039002-) .65m high, part of which has been reformed as a trigonometrical station. To the W, SW and S of the site is an arc of a large bank of clay and stones. It is not clear whether this is related to the cashel or not. The site is located in rough pasture on top of a ridge commanding an excellent view of Donegal Bay.

DG103-03902- Lurgan Cairn - Unclassified

A subcircular area (DG103-039001-) enclosed by a collapsed stone wall surviving only 10cms in height. In places the wall is gone but can be traced in the line of the rock outcrop which it originally followed along the ENE side. There are several clearings in the wall collapse presumably of a recent date. At the NE end are the remains of a cairn .65m high, part of which has been reformed as a trigonometrical station. To the W, SW and S of the site is an arc of a large bank of clay and stones. It is not clear whether this is related to the cashel or not. The site is located in rough pasture on top of a ridge commanding an excellent view of Donegal Bay.

APPENDIX 13-2

APPENDIX 13-2

SITES IN THE SITES AND MONUMENTS RECORD ('SMR') IN THE STUDY AREA

DG103-072001- Lurgan Ringfort - cashel

Within a possible hillfort (DG103-072----) is a sub-circular area (internal diam. c. 35m) enclosed by a collapsed stone wall surviving only 0.1m in height. In places the wall appears to have been removed but can be traced in the line of the rock outcrop which it originally followed along the ENE side. There are several clearings in the wall collapse which may be of recent date. At the NE end are the remains of a cairn (DG103-029----).

DG103-072---- Lurgan Hillfort

This large ridge-top enclosure appears to be a hillfort, although it has been suggested that it is a Neolithic enclosure. It encloses the summit of a N-S limestone ridge, with panoramic views encompassing the immediate undulating landscape, as well as distant landmarks of several counties: Donegal Bay, Slieve League and the Blue Stack mountains at NW–NE; the mountains of Leitrim and Sligo, the Mullaghmore Peninsula and Inish Murray at SE–SW; and Nephin Mountain in Mayo at WSW.

It consists of a roughly oval or D-shaped area (335m N–S; 190m E–W) defined on its W half at SSE–N by a substantial stone bank/wall which follow a contour of the ridge in a broad, smooth curve. On the E side, from NE-SE, it is naturally delimited by a steep limestone escarpment. The enclosing stone bank (Wth c. 10-12m; int. H 0.5-1.1m; ext. H 1.4-1.7m) consists of a substantial mound of medium and large limestone rubble, now broadly slumped and largely grass-covered. Within the enclosed area, a plateau (Wth c. 75m E-W) forms a relatively level central spine from which ground falls steeply outwards towards the enclosing wall. Within the confines of the hillfort there are several monuments: A cairn (DG103-029----), which is incorporated into the E half of a circular enclosure (DG103-072001-), crowns the highest point of the plateau in the N half of the hillfort. Another circular enclosure (DG103-092----) is located c. 13.5m to SE and is conjoined on its E side with a possible house (DG103-093----). Traces of levelled field boundaries, of uncertain date, are evident in the N half of the interior, and several shallow, subcircular or semi-circular hollows (max. dim 5-10m), of unknown date and function, are scarped into the NW and W-facing slope. A number of modern field walls subdivide the W and S half of the interior. There are also several monuments in the immediate vicinity: Abutting the exterior face of the enclosing wall at the S, is another circular enclosure (DG103-094----), and a possible hut site (DG103-095----) lies c. 35m S of that. A possible cairn (DG103-032----) is located at a lower point on the same ridge c. 120m S of the hillfort. There is a court tomb (DG103-030----) 150m downslope from the hillfort on the W side of the ridge, and an enclosure (DG103-091----) c. 100m to NW of the hillfort, on a terrace on the N slope of the ridge.

DG103-073---- Ballymagrorty Scotch Enclosure

In pasture, located on level ground broken by limestone bedrock on top of a broad hill, overlooked at NW by a higher ridge. On its NE-S side, the hill drops into a small valley with two interconnected lakes, known as Garvanagh Lough, from the S end of which a stream/drain flows, skirting the base of the hill at SW. This enclosure is not indicated on the 1836 OS 6-inch map but is indicated on the 1907 edition as a polygonal enclosure, bordered at E by a NW-SE field boundary. It consists of an oval area (39.5m NW-SE; 28m NE-SW) defined by a stone bank/ruined wall (Wth 2-3m; H 0.2-0.3m). The stone bank appears as a low, moss- and

sod-covered rise from which stones protrude randomly. At NE-SE, it is incorporated into a later NW-SE field wall. Ruined field walls, on a NE-SW axis, also intersect with the enclosure at E and W. The interior of the enclosure is not raised above exterior ground level. It is relatively level but has an uneven surface broken by much moss-covered stone/karst, concentrated in a band extending through the W half. In the SE quadrant there is a shallow depression bordering the inner edge of the enclosing stone bank. There is another enclosure (DG103-074----) 16m to SE.

DG103-075---- Garvanagh Enclosure

In rough pasture, broken by seams of karst outcropping. Immediately to N, the ground shelves down into an E–W stream valley, overlooked on the N side by a high ridge. There are ruined vernacular farm buildings in the adjoining field to W. This enclosure is not indicated on any edition of the OS 6-inch maps. It consists of a broadly oval area (c. 25m N-S; 21.5m E-W) defined by a low-profile bank (Wth 2-2.5m; H 0.3m). It is not clear whether the enclosing bank is earthen or has a stony core. It can be traced at WSW-NE as a very low, grass-covered rise. It is incorporated at NE-SE into a later field wall, now reduced to a jumble of stones. At SSE-SSW the outline of the enclosure is barely discernible, and here, along or just inside the original line of the enclosing bank, there is an area (c. 3.5-4m E-W) of disturbance where a seam of limestone bedrock has been quarried out. The interior of the enclosure is level and not noticeably raised above exterior ground level.

DG103-076---- Garvanagh Hut site

In a pasture field, located adjacent to an E-W field wall bordering the N side of the field. Immediately to N of the field wall, the ground shelves down into an E-W stream valley.

This feature is not shown on any edition of the OS 6-inch maps. It consists of a circular area (diam. 6m) defined by a stone bank/wall (Wth 1m; H 0.3m). The stone bank is evident as a low, sod-covered rise, most clearly defined on the E half of the feature. No stones are visible but they can be felt beneath the sod cover. There is a gap (Wth 1.4m) in the enclosing bank at N, facing the natural slope which drops into the stream valley. The interior appears slightly sunken relative to exterior ground level. The remains of this feature are poorly preserved and its function is unclear. It may be a hut site but it is also possible that it is a relatively late feature, such as an animal pen, associated with a ruined vernacular farmstead located 40m to E. There is an enclosure (DG103-075----) located c. 80m to E.

DG103-077---- Garvanagh Burnt mound

In pasture, located on the bank of a W-flowing stream/drain, in the base of an E-W valley. The stream (Wth 2m) has been dredged in the past, and small mounds of upcast soil line the N bank in parts, though not in the vicinity of the burnt mound. On OS 25-inch plan, a ‘Spring’ is marked on the S side of the stream a few meters to W of the location of the burnt mound. The spring is no longer evident. This burnt mound is visible in section in the N bank of the stream. In the exposed section face (H 0.6-0.7m) a band (L c. 4m E-W; T c. 0.1m) of charcoal-rich soil and burnt stone fragments occurs immediately beneath the sod layer (T 0.1m) and overlies a layer (T 0.25-0.3m) of peat which in turn overlies a basal layer of sand. The S bank of the stream is largely obscured by grass but a very small eroded section also reveals what appears to be burnt material. No mound or rise is evident at surface level on either side of the stream.

DG103-082---- Glasbolie Enclosure

In pasture, broken by seams of limestone out-cropping, located on the gentle S-facing slope of a ridge, providing excellent views E–SW of the surrounding hilly terrain. The N and E sides of the field are bordered by commercial quarry pits. Circular area (19.5m E–W; 17m N–S), with a gently sunken interior, defined on the perimeter by a ruined stone bank/wall (Wth 2m; int. H 0.45-0.55; ext. H 0.3-0.5m). The enclosing wall is largely sod-covered, with stones protruding from the sod in parts. At NW–N and at S–SW it is evident only as grass-covered undulation. At W it is truncated or overlain by a later field wall/property boundary on a NNW–SSE axis. The enclosure has a shallow, saucer-like profile. There are two possible hut sites (DG103-083----; DG103-084----) located 40m and 60m, respectively, to SSE.

DG103-083---- Glasbolie Hut site

In pasture, broken by rock outcropping on a ridge, which provides excellent views E–SW of the surrounding hilly limestone terrain. The N and E sides of the field are bordered by commercial quarry pits. Oval area (int. diam. 4m NW–SE; 3m NE–SW) defined by a stone bank/wall (Wth 1m; int. H 0.3m; ext. H 0.2m). The interior appears very slightly sunken. There is a gap (Wth 1m) in the enclosing wall at SE. The outline is low, sod-covered and barely discernible. There is another possible hut site (DG103-103-084----) located 15m to S, and an enclosure (DG103-082----) c. 40m to NNW.

DG103-084---- Glasbolie Hut site

In pasture, broken by rock outcropping on a ridge, which provides excellent views E–SW of the surrounding hilly limestone terrain. The N and E sides of the field are bordered by commercial quarry pits. Oval area (int. diam. 4.2m NW–SE; 3.2m NE–SW) defined by a stone bank/wall (Wth 1m; H 0.3m), with a gap (Wth c. 1.5m) at SE. The outline of this possible hut site is low, sod-covered and barely discernible. There is another possible hut site (DG103-083----) located 15m to N, and an enclosure (DG103-082----) c. 60 m to NNW.

DG103-085---- Lurgan Enclosure

In pasture, located on top of a knoll in undulating, hilly limestone terrain, with views to W over Donegal Bay, and overlooked to S by Lurgan Hill. Subcircular area (32m E–W; 26.5m N–S) defined by a scarp, which encompasses the flat top of the knoll. At SSE–W the enclosing scarp (H 0.5-0.8m) coincides with the steep natural slope of the knoll. At NW–NNE it is topped in parts with a slight stony rim, probably the remnants of a wall. At NE–ESE it is difficult to trace, and is partly obscured at NE by the wall footings (H 0.2-0.3m) of a rectangular two-roomed house (overall L c. 18-19m E–W; Wth 5-6m), and at E–SE by a later field fence/property boundary, engulfed in brambles, which skirts the enclosure. The date of the enclosure is uncertain: In size, shape, siting, and when seen in aerial views, it could be interpreted as a ringfort. It is also possible, however, that it is late in date, contemporary with the rectangular house which appears to be vernacular in style but is not shown on the 1836 and 1907 OS 6-inch maps.

DG103-091---- Lurgan Enclosure

In pasture, encompassing a shallow, natural depression on a terrace on the N-facing slope of a N–S limestone ridge. The N edge of the terrace, c. 10m N of the enclosure, is defined by a steep, almost vertical limestone escarpment. To SE ground rises steeply to the summit of the ridge which is enclosed by a hillfort (DG103-072----) and crowned by a cairn (DG103-029----). Broadly oval area (27m E–W; 22.5m N–S) defined by a ruined stone wall. The wall is evident as a low, gapped, moss-covered rise (Wth 1-1.5m) from which occasional large and medium-

sized stones protrude. At SE–W it has a pronounced internal scarp (H 0.7-1.2m) but is almost flush with exterior ground level. At NE–SE it is incorporated into a later N–S field wall. The interior appears slightly sunken, and slopes down gently from S to N. A gapped line of sod-covered stones appears to define a roughly trapezoidal area (c. 3m E–W; 2m N-S at W end) abutting the inner face of enclosing wall at N, possibly the remnants of a structure such as an animal pen or hut. On the N side of the enclosure, there is a gap (Wth 1.4m) in the enclosing wall. This faces a narrow gully on the N edge of the terrace, which provides a natural route way down the steep escarpment to the base of the ridge.

DG103-092---- Lurgan Enclosure

In pasture, located roughly in the centre of a hillfort (DG103-072----) on the top of a N–S limestone ridge. This enclosure consists of a flat, circular area (22m N–S; 22m E–W) defined on the perimeter by a slight, grass-covered rise, marked by mossy tussocks and occasional stones. There is a break (Wth c. 6m) at N–NNE. The enclosure is barely discernible at ground level. It is located on a plateau which forms a spine of relatively level ground extending N–S through the centre of the hillfort. The enclosure is conjoined on its E side to a possible circular house (DG103-093----). There is a larger circular enclosure (DG103-072----) 13.5m to N, within which there is a cairn (DG103-029----) marking the highest point of the ridge.

DG103-092---- Lurgan House – indeterminate date

In pasture, located roughly in the centre of a hillfort (DG103-072----) on the top of a N–S limestone ridge. This possible house or small enclosure consists of a flat, circular area (10m N–S; 9.5m E–W) defined by a stone bank (Wth 1.5m). The stone bank is evident as a low, sod-covered rise from which occasional stones protrude. It is most clearly defined at N–NE where a slight drop in exterior ground level makes the external face of the stone bank (ext. H 0.65m) more pronounced. It is located on a plateau which forms a spine of relatively level ground extending N–S through the hillfort. The possible house is conjoined on its W side to a circular enclosure (DG103-092----). There is a larger circular enclosure (DG103-072----) 20m to N, within which there is a cairn (DG103-029----) marking the highest point of the ridge.

DG103-094---- Lurgan Enclosure

In pasture, located on a N–S limestone ridge, abutting the S side of a hillfort (DG103-072----).

This enclosure is barely discernible at ground level. It consists of a roughly circular area (diam. 20m) defined on the perimeter at NNE–NNW by a very low, moss-covered stone bank (Wth 1.5-2m), and bordered at N by the stone bank of the hillfort (DG103-072----). The enclosing stone bank is most clearly defined at NNE–E but it more difficult to trace S–W. The interior is flat and grass-covered but feels stony underfoot and appears to incorporate expanses of natural limestone bedrock: the enclosure is located on a broad seam of limestone bedrock that continues to N and S beyond the enclosure. The slumped external slope of the enclosing stone bank of the hillfort appears to overlie the junction of the two monuments, and the exact relationship between the two is unclear. There is a possible hut site (DG103-095----) c. 25m to S.

DG103-095---- Lurgan Hut site

In pasture, located on a spine of rocky ground on top of a N–S limestone ridge. The precipitous E-facing slope of the ridge lies 20m to E. This small circular feature is barely discernible at ground level, and its date and function are uncertain. It consists of a roughly circular area (6m

N–S; 5m E–W) defined on the perimeter at NNE–NNW by a very low, moss-covered rise (Wth 0.6-1m; H 0.2m) which appears to be the remnants of a stone bank or wall. The interior is flat and grass-covered but feels stony underfoot and appears to incorporate expanses of natural limestone bedrock: it is located on a broad seam of limestone bedrock that continues to N and S beyond the hut site. There is a possible enclosure (DG103-094----) 30m to N and a hillfort (DG103-072----) 50m to N, and a possible cairn (DG103-032----) 60m to S.

APPENDIX 14

APPENDIX 14-1

TRACSIS

TRAFFIC DATA

Transport Data Collection and Analytics

Junction Turning Count

Project Number: 3939-IRE
Project Name: N15, Donegal
Client: Roadplan Consulting

Sites: J1
Survey Date: 18/09/2024

Survey Time: 07:00-19:00 **Weather:** Dry

Observations: No incidents or observations during the survey period.

Tracsis will retain all personal data relating to this project, including all video images, for a period of three months after receipt of this report and all other data files for one year.

If you would like a copy of the personal data or wish for us to retain for a longer period, please do not hesitate to contact us.

TRAFFIC DATA
Transport Data Collection and Analytics

3939-IRE N15, Donegal
Junction Turning Count
18/09/2024

Site J1_18092024 - N15 National Road(N) / Access Road / N15 National Road(S)

Origin Arm A N15 National Road(N)

	Destination : Arm A N15 National Road(N)								**Destination :** Arm B Access Road								**Destination :** Arm C N15 National Road(S)								Arm
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Totals
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	18	3	4	3	1	0	80	80
07:15	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	5	36	17	3	3	2	0	0	61	66
07:30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	54	25	1	7	2	2	0	91	92
07:45	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	78	24	7	6	2	0	0	117	120
1 Hr	0	0	0	0	0	0	0	0	1	0	0	8	0	0	0	9	219	84	14	20	9	3	0	349	358
08:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	86	31	3	4	2	1	0	127	128
08:15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	82	19	5	8	4	0	0	118	119
08:30	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	5	100	20	4	5	2	0	0	131	136
08:45	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3	89	16	1	5	1	0	0	112	115
1 Hr	0	0	0	0	0	0	0	0	1	0	2	7	0	0	0	10	357	86	13	22	9	1	0	488	498
09:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	70	12	1	2	4	1	0	90	91
09:15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	47	19	3	4	2	0	0	75	76
09:30	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	51	18	5	2	1	0	0	77	80
09:45	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	62	24	6	9	2	0	0	103	105
1 Hr	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	7	230	73	15	17	9	1	0	345	352
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	14	5	2	4	0	1	60	60
10:15	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	50	13	4	6	1	0	0	74	77
10:30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	49	10	4	5	2	0	0	70	71
10:45	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	57	13	2	5	0	0	0	77	79
1 Hr	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6	190	50	15	18	7	0	1	281	287
11:00	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	51	12	8	4	0	0	0	75	77
11:15	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3	62	9	2	6	1	0	0	80	83
11:30	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	51	11	2	3	0	0	1	68	71
11:45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	46	10	2	3	2	0	0	63	64
1 Hr	0	0	0	0	0	0	0	0	0	0	2	7	0	0	0	9	210	42	14	16	3	0	1	286	295
12:00	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	72	15	0	5	1	0	0	93	96
12:15	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	54	8	4	6	0	0	0	72	74
12:30	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	4	66	8	1	7	4	2	1	89	93
12:45	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	4	59	4	3	5	1	0	0	72	76
1 Hr	0	0	0	0	0	0	0	0	1	0	3	9	0	0	0	13	251	35	8	23	6	2	1	326	339
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	16	6	7	1	0	0	100	100
13:15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	61	10	1	0	0	0	0	72	73
13:30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	47	14	2	3	0	0	0	66	67
13:45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	51	14	1	4	0	2	0	72	73
1 Hr	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3	229	54	10	14	1	2	0	310	313
14:00	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	55	11	2	1	1	1	0	71	75
14:15	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	69	13	2	2	1	0	0	87	90
14:30	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	63	12	1	4	1	0	1	82	84
14:45	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3	65	12	2	5	2	0	0	86	89
1 Hr	0	0	0	0	0	0	0	0	0	1	0	11	0	0	0	12	252	48	7	12	5	1	1	326	338
15:00	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	4	75	10	1	4	2	0	0	92	96
15:15	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	65	15	4	3	1	0	0	88	92
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	14	1	3	1	0	1	92	92
15:45	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	68	10	0	3	0	0	0	81	83
1 Hr	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	10	280	49	6	13	4	0	1	353	363
16:00	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	62	16	1	1	3	0	0	83	85
16:15	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3	74	25	1	3	1	0	0	104	107
16:30	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	75	14	4	7	1	0	0	101	103
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	16	1	2	0	2	0	107	107
1 Hr	0	0	0	0	0	0	0	0	1	2	0	4	0	0	0	7	297	71	7	13	5	2	0	395	402
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	24	4	4	1	3	0	131	131
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	14	1	4	1	0	1	112	112
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	11	1	2	3	0	0	77	77
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	13	3	5	0	1	0	112	112
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	336	62	9	15	5	4	1	432	432
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	15	2	5	0	1	0	95	95
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	11	0	0	0	2	0	67	67
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	14	0	1	0	0	0	77	77
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	10	2	6	0	0	0	77	77
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247	50	4	12	0	3	0	316	316
Total	0	0	0	0	0	0	0	0	5	4	9	68	0	0	0	86	3098	704	122	195	63	19	6	4207	4293

TRAFFIC DATA
Transport Data Collection and Analytics

3939-IRE N15, Donegal
Junction Turning Count
18/09/2024

Site J1_18092024 - N15 National Road(N) / Access Road / N15 National Road(S)

Origin Arm B Access Road

	Destination : Arm A N15 National Road(N)								**Destination :** Arm B Access Road								**Destination :** Arm C N15 National Road(S)								Arm
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Totals
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	6
1 Hr	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	7
08:00	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
08:15	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	3	5
08:30	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:45	0	0	1	3	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	6
1 Hr	0	0	1	10	0	0	0	11	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	5	16
09:00	1	1	1	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	6
09:15	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4
09:30	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
09:45	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	4
1 Hr	1	1	1	6	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7	16
10:00	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3	5
10:45	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3	6
1 Hr	0	0	0	6	0	0	0	6	0	0	0	0	0	0	0	0	2	2	0	3	0	0	0	7	13
11:00	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	5
11:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
11:30	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	7
11:45	1	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	6
1 Hr	1	0	0	12	0	0	0	13	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	6	19
12:00	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3
12:15	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
12:30	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3
12:45	1	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	6
1 Hr	1	0	0	8	0	0	0	9	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	5	14
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
13:15	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13:30	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	4
13:45	0	1	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	4
1 Hr	1	1	2	2	0	0	0	6	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	4	10
14:00	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	3
14:15	0	1	0	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
14:30	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
14:45	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3
1 Hr	0	1	0	11	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	15
15:00	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	5
15:15	0	0	1	2	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	5
15:30	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
15:45	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
1 Hr	0	0	1	9	0	0	0	10	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	5	15
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	2
16:15	1	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	5
16:30	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	3
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	2
1 Hr	1	0	0	4	0	0	0	5	0	0	0	0	0	0	0	0	1	3	0	3	0	0	0	7	12
17:00	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	6	7
17:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0	7	8
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	3	5	73	0	0	0	87	0	0	0	0	0	0	0	0	11	8	4	35	0	0	0	58	145

TRAFFIC DATA
Transport Data Collection and Analytics

3939-IRE N15, Donegal
Junction Turning Count
18/09/2024

Site J1_18092024 - N15 National Road(N) / Access Road / N15 National Road(S)

Origin Arm C N15 National Road(S)

	Destination : Arm A N15 National Road(N)								**Destination :** Arm B Access Road								**Destination :** Arm C N15 National Road(S)								Arm
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Totals
07:00	26	10	1	3	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
07:15	25	9	4	5	0	0	0	43	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	45
07:30	50	26	2	3	2	0	0	83	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	85
07:45	42	22	4	1	1	0	0	70	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	72
1 Hr	143	67	11	12	3	0	0	236	3	2	0	1	0	0	0	6	0	0	0	0	0	0	0	0	242
08:00	53	18	2	2	2	0	0	77	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	79
08:15	74	16	3	3	1	0	0	97	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	98
08:30	80	14	1	6	3	0	0	104	1	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	107
08:45	97	22	3	8	3	1	0	134	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	135
1 Hr	304	70	9	19	9	1	0	412	2	0	0	5	0	0	0	7	0	0	0	0	0	0	0	0	419
09:00	49	17	0	1	5	1	0	73	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	74
09:15	58	21	2	2	2	0	0	85	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	86
09:30	64	10	2	6	2	0	1	85	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	87
09:45	53	15	5	7	1	0	0	81	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	82
1 Hr	224	63	9	16	10	1	1	324	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	329
10:00	57	13	9	3	2	1	0	85	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	86
10:15	53	8	0	4	2	0	0	67	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	68
10:30	53	11	1	5	0	0	0	70	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	72
10:45	53	10	1	2	1	0	0	67	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	69
1 Hr	216	42	11	14	5	1	0	289	1	0	0	5	0	0	0	6	0	0	0	0	0	0	0	0	295
11:00	45	10	0	5	0	0	0	60	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	62
11:15	51	9	0	5	2	0	0	67	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	69
11:30	56	7	2	9	3	1	1	79	1	1	0	1	0	0	0	3	0	0	0	0	0	0	0	0	82
11:45	43	10	6	3	1	0	0	63	1	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	66
1 Hr	195	36	8	22	6	1	1	269	3	1	0	6	0	0	0	10	0	0	0	0	0	0	0	0	279
12:00	57	20	3	7	1	1	0	89	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	90
12:15	54	12	6	2	2	0	0	76	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	77
12:30	52	12	4	3	0	0	0	71	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	73
12:45	62	8	3	5	1	0	0	79	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	82
1 Hr	225	52	16	17	4	1	0	315	0	0	0	7	0	0	0	7	0	0	0	0	0	0	0	0	322
13:00	60	10	1	2	1	1	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75
13:15	62	10	1	9	2	1	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
13:30	55	13	2	3	1	0	0	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74
13:45	82	9	2	2	0	0	0	95	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	97
1 Hr	259	42	6	16	4	2	0	329	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	331
14:00	69	12	4	6	0	6	0	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97
14:15	54	7	0	5	2	2	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
14:30	70	18	1	2	0	0	1	92	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	95
14:45	61	12	2	5	1	0	0	81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81
1 Hr	254	49	7	18	3	8	1	340	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	343
15:00	62	12	0	4	3	2	1	84	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	85
15:15	80	15	1	3	1	1	0	101	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	102
15:30	91	11	3	6	2	0	0	113	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	114
15:45	73	15	2	7	0	2	0	99	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	100
1 Hr	306	53	6	20	6	5	1	397	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	401
16:00	80	26	4	4	3	1	0	118	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	121
16:15	79	8	0	2	3	0	0	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92
16:30	96	22	1	1	2	0	0	122	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	123
16:45	79	27	4	5	3	0	0	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118
1 Hr	334	83	9	12	11	1	0	450	0	1	0	3	0	0	0	4	0	0	0	0	0	0	0	0	454
17:00	94	20	3	3	0	8	0	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128
17:15	81	33	2	5	1	0	0	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122
17:30	101	25	1	2	0	0	1	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	130
17:45	80	24	4	2	0	4	0	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114
1 Hr	356	102	10	12	1	12	1	494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	494
18:00	74	15	3	2	3	1	0	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98
18:15	85	15	4	2	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106
18:30	82	12	0	0	0	0	1	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
18:45	63	18	2	1	1	0	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
1 Hr	304	60	9	5	4	1	1	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	384
Total	3120	719	111	183	66	34	6	4239	9	4	0	41	0	0	0	54	0	0	0	0	0	0	0	0	4293

TRAFFIC DATA
Transport Data Collection and Analytics

3939-IRE N15, Donegal
Junction Turning Count
18/09/2024

Site J1_18092024 - N15 National Road(N) / Access Road / N15 National Road(S)

ORIGIN SUMMARY

	Origin : Arm A N15 National Road(N)								Origin : Arm B Access Road								Origin : Arm C N15 National Road(S)								Origin Totals
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	
07:00	51	18	3	4	3	1	0	80	0	0	0	0	0	0	0	0	26	10	1	3	0	0	0	40	120
07:15	37	17	3	7	2	0	0	66	1	0	0	0	0	0	0	1	26	10	4	5	0	0	0	45	112
07:30	54	25	1	8	2	2	0	92	0	0	0	0	0	0	0	0	51	27	2	3	2	0	0	85	177
07:45	78	24	7	9	2	0	0	120	0	0	0	6	0	0	0	6	43	22	4	2	1	0	0	72	198
1 Hr	220	84	14	28	9	3	0	358	1	0	0	6	0	0	0	7	146	69	11	13	3	0	0	242	607
08:00	86	31	3	5	2	1	0	128	0	0	0	4	0	0	0	4	54	18	2	3	2	0	0	79	211
08:15	82	19	6	8	4	0	0	119	1	0	0	4	0	0	0	5	74	16	3	4	1	0	0	98	222
08:30	100	20	5	9	2	0	0	136	0	0	0	1	0	0	0	1	81	14	1	8	3	0	0	107	244
08:45	90	16	1	7	1	0	0	115	1	0	1	4	0	0	0	6	97	22	3	9	3	1	0	135	256
1 Hr	358	86	15	29	9	1	0	498	2	0	1	13	0	0	0	16	306	70	9	24	9	1	0	419	933
09:00	70	12	1	3	4	1	0	91	1	1	1	3	0	0	0	6	49	17	0	2	5	1	0	74	171
09:15	47	19	3	5	2	0	0	76	0	0	0	4	0	0	0	4	58	21	2	3	2	0	0	86	166
09:30	51	18	5	5	1	0	0	80	0	0	0	2	0	0	0	2	64	10	2	8	2	0	1	87	169
09:45	62	25	6	10	2	0	0	105	0	0	0	4	0	0	0	4	53	15	5	8	1	0	0	82	191
1 Hr	230	74	15	23	9	1	0	352	1	1	1	13	0	0	0	16	224	63	9	21	10	1	1	329	697
10:00	34	14	5	2	4	0	1	60	1	0	0	1	0	0	0	2	57	13	9	4	2	1	0	86	148
10:15	50	13	4	9	1	0	0	77	0	0	0	0	0	0	0	0	54	8	0	4	2	0	0	68	145
10:30	49	10	4	6	2	0	0	71	0	1	0	4	0	0	0	5	53	11	1	7	0	0	0	72	148
10:45	57	13	2	7	0	0	0	79	1	1	0	4	0	0	0	6	53	10	1	4	1	0	0	69	154
1 Hr	190	50	15	24	7	0	1	287	2	2	0	9	0	0	0	13	217	42	11	19	5	1	0	295	595
11:00	51	12	9	5	0	0	0	77	0	0	1	4	0	0	0	5	46	10	0	6	0	0	0	62	144
11:15	62	9	3	8	1	0	0	83	0	0	0	1	0	0	0	1	51	9	0	7	2	0	0	69	153
11:30	51	11	2	6	0	0	1	71	0	0	0	7	0	0	0	7	57	8	2	10	3	1	1	82	160
11:45	46	10	2	4	2	0	0	64	1	0	0	5	0	0	0	6	44	10	6	5	1	0	0	66	136
1 Hr	210	42	16	23	3	0	1	295	1	0	1	17	0	0	0	19	198	37	8	28	6	1	1	279	593
12:00	72	15	0	8	1	0	0	96	0	0	0	3	0	0	0	3	57	20	3	8	1	1	0	90	189
12:15	54	8	4	8	0	0	0	74	0	0	0	2	0	0	0	2	54	12	6	3	2	0	0	77	153
12:30	66	8	2	10	4	2	1	93	0	0	0	3	0	0	0	3	52	12	4	5	0	0	0	73	169
12:45	60	4	5	6	1	0	0	76	1	0	1	4	0	0	0	6	62	8	3	8	1	0	0	82	164
1 Hr	252	35	11	32	6	2	1	339	1	0	1	12	0	0	0	14	225	52	16	24	4	1	0	322	675
13:00	70	16	6	7	1	0	0	100	0	0	0	1	0	0	0	1	60	10	1	2	1	1	0	75	176
13:15	62	10	1	0	0	0	0	73	0	0	0	1	0	0	0	1	62	10	1	9	2	1	0	85	159
13:30	47	14	2	4	0	0	0	67	1	0	1	2	0	0	0	4	55	13	2	3	1	0	0	74	145
13:45	51	14	1	5	0	2	0	73	0	1	3	0	0	0	0	4	82	9	2	4	0	0	0	97	174
1 Hr	230	54	10	16	1	2	0	313	1	1	4	4	0	0	0	10	259	42	6	18	4	2	0	331	654
14:00	55	11	2	5	1	1	0	75	0	0	0	3	0	0	0	3	69	12	4	6	0	6	0	97	175
14:15	69	13	2	5	1	0	0	90	0	1	0	5	0	0	0	6	54	7	0	5	2	2	0	70	166
14:30	63	12	1	6	1	0	1	84	0	0	0	3	0	0	0	3	70	18	1	5	0	0	1	95	182
14:45	65	13	2	7	2	0	0	89	0	0	0	3	0	0	0	3	61	12	2	5	1	0	0	81	173
1 Hr	252	49	7	23	5	1	1	338	0	1	0	14	0	0	0	15	254	49	7	21	3	8	1	343	696
15:00	75	10	3	6	2	0	0	96	0	0	0	5	0	0	0	5	62	12	0	5	3	2	1	85	186
15:15	65	15	4	7	1	0	0	92	1	0	1	3	0	0	0	5	80	15	1	4	1	1	0	102	199
15:30	72	14	1	3	1	0	1	92	0	0	0	3	0	0	0	3	91	11	3	7	2	0	0	114	209
15:45	68	10	0	5	0	0	0	83	0	0	0	2	0	0	0	2	73	15	2	8	0	2	0	100	185
1 Hr	280	49	8	21	4	0	1	363	1	0	1	13	0	0	0	15	306	53	6	24	6	5	1	401	779
16:00	62	16	1	3	3	0	0	85	0	1	0	1	0	0	0	2	80	26	4	7	3	1	0	121	208
16:15	75	25	1	5	1	0	0	107	1	0	0	4	0	0	0	5	79	8	0	2	3	0	0	92	204
16:30	75	16	4	7	1	0	0	103	0	1	0	2	0	0	0	3	96	23	1	1	2	0	0	123	229
16:45	86	16	1	2	0	2	0	107	1	1	0	0	0	0	0	2	79	27	4	5	3	0	0	118	227
1 Hr	298	73	7	17	5	2	0	402	2	3	0	7	0	0	0	12	334	84	9	15	11	1	0	454	868
17:00	95	24	4	4	1	3	0	131	4	3	0	0	0	0	0	7	94	20	3	3	0	8	0	128	266
17:15	91	14	1	4	1	0	1	112	0	0	0	0	0	0	0	0	81	33	2	5	1	0	0	122	234
17:30	60	11	1	2	3	0	0	77	1	0	0	0	0	0	0	1	101	25	1	2	0	0	1	130	208
17:45	90	13	3	5	0	1	0	112	0	0	0	0	0	0	0	0	80	24	4	2	0	4	0	114	226
1 Hr	336	62	9	15	5	4	1	432	5	3	0	0	0	0	0	8	356	102	10	12	1	12	1	494	934
18:00	72	15	2	5	0	1	0	95	0	0	0	0	0	0	0	0	74	15	3	2	3	1	0	98	193
18:15	54	11	0	0	0	2	0	67	0	0	0	0	0	0	0	0	85	15	4	2	0	0	0	106	173
18:30	62	14	0	1	0	0	0	77	0	0	0	0	0	0	0	0	82	12	0	0	0	0	1	95	172
18:45	59	10	2	6	0	0	0	77	0	0	0	0	0	0	0	0	63	18	2	1	1	0	0	85	162
1 Hr	247	50	4	12	0	3	0	316	0	0	0	0	0	0	0	0	304	60	9	5	4	1	1	384	700
Total	3103	708	131	263	63	19	6	4293	17	11	9	108	0	0	0	145	3129	723	111	224	66	34	6	4293	8731

TRAFFIC DATA
Transport Data Collection and Analytics

3939-IRE N15, Donegal
Junction Turning Count
18/09/2024

Site J1_18092024 - N15 National Road(N) / Access Road / N15 National Road(S)

DESTINATION SUMMARY

	Destination : Arm A N15 National Road(N)								**Destination :** Arm B Access Road								**Destination :** Arm C N15 National Road(S)								Dest
	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Car	LGV	OGV1	OGV2	PSV	MC	PC	Total	Totals
07:00	26	10	1	3	0	0	0	40	0	0	0	0	0	0	0	0	51	18	3	4	3	1	0	80	120
07:15	25	9	4	5	0	0	0	43	2	1	0	4	0	0	0	7	37	17	3	3	2	0	0	62	112
07:30	50	26	2	3	2	0	0	83	1	1	0	1	0	0	0	3	54	25	1	7	2	2	0	91	177
07:45	42	22	4	6	1	0	0	75	1	0	0	4	0	0	0	5	78	24	7	7	2	0	0	118	198
1 Hr	143	67	11	17	3	0	0	241	4	2	0	9	0	0	0	15	220	84	14	21	9	3	0	351	607
08:00	53	18	2	6	2	0	0	81	1	0	0	2	0	0	0	3	86	31	3	4	2	1	0	127	211
08:15	74	16	3	5	1	0	0	99	0	0	1	1	0	0	0	2	83	19	5	10	4	0	0	121	222
08:30	80	14	1	7	3	0	0	105	1	0	1	6	0	0	0	8	100	20	4	5	2	0	0	131	244
08:45	97	22	4	11	3	1	0	138	1	0	0	3	0	0	0	4	90	16	1	6	1	0	0	114	256
1 Hr	304	70	10	29	9	1	0	423	3	0	2	12	0	0	0	17	359	86	13	25	9	1	0	493	933
09:00	50	18	1	2	5	1	0	77	0	0	0	2	0	0	0	2	70	12	1	4	4	1	0	92	171
09:15	58	21	2	5	2	0	0	88	0	0	0	2	0	0	0	2	47	19	3	5	2	0	0	76	166
09:30	64	10	2	7	2	0	1	86	0	0	0	5	0	0	0	5	51	18	5	3	1	0	0	78	169
09:45	53	15	5	8	1	0	0	82	0	1	0	2	0	0	0	3	62	24	6	12	2	0	0	106	191
1 Hr	225	64	10	22	10	1	1	333	0	1	0	11	0	0	0	12	230	73	15	24	9	1	0	352	697
10:00	57	13	9	4	2	1	0	86	0	0	0	1	0	0	0	1	35	14	5	2	4	0	1	61	148
10:15	53	8	0	4	2	0	0	67	1	0	0	3	0	0	0	4	50	13	4	6	1	0	0	74	145
10:30	53	11	1	7	0	0	0	72	0	0	0	3	0	0	0	3	49	11	4	7	2	0	0	73	148
10:45	53	10	1	5	1	0	0	70	0	0	0	4	0	0	0	4	58	14	2	6	0	0	0	80	154
1 Hr	216	42	11	20	5	1	0	295	1	0	0	11	0	0	0	12	192	52	15	21	7	0	1	288	595
11:00	45	10	0	9	0	0	0	64	1	0	1	2	0	0	0	4	51	12	9	4	0	0	0	76	144
11:15	51	9	0	5	2	0	0	67	0	0	1	4	0	0	0	5	62	9	2	7	1	0	0	81	153
11:30	56	7	2	14	3	1	1	84	1	1	0	4	0	0	0	6	51	11	2	5	0	0	1	70	160
11:45	44	10	6	6	1	0	0	67	1	0	0	3	0	0	0	4	46	10	2	5	2	0	0	65	136
1 Hr	196	36	8	34	6	1	1	282	3	1	2	13	0	0	0	19	210	42	15	21	3	0	1	292	593
12:00	57	20	3	9	1	1	0	91	0	0	0	4	0	0	0	4	72	15	0	6	1	0	0	94	189
12:15	54	12	6	3	2	0	0	77	0	0	0	3	0	0	0	3	54	8	4	7	0	0	0	73	153
12:30	52	12	4	5	0	0	0	73	0	0	1	5	0	0	0	6	66	8	1	8	4	2	1	90	169
12:45	63	8	3	8	1	0	0	83	1	0	2	4	0	0	0	7	59	4	4	6	1	0	0	74	164
1 Hr	226	52	16	25	4	1	0	324	1	0	3	16	0	0	0	20	251	35	9	27	6	2	1	331	675
13:00	60	10	1	2	1	1	0	75	0	0	0	0	0	0	0	0	70	16	6	8	1	0	0	101	176
13:15	62	10	1	10	2	1	0	86	1	0	0	0	0	0	0	1	61	10	1	0	0	0	0	72	159
13:30	56	13	2	4	1	0	0	76	0	0	0	1	0	0	0	1	47	14	3	4	0	0	0	68	145
13:45	82	10	4	2	0	0	0	98	0	0	0	3	0	0	0	3	51	14	2	4	0	2	0	73	174
1 Hr	260	43	8	18	4	2	0	335	1	0	0	4	0	0	0	5	229	54	12	16	1	2	0	314	654
14:00	69	12	4	7	0	6	0	98	0	0	0	4	0	0	0	4	55	11	2	3	1	1	0	73	175
14:15	54	8	0	10	2	2	0	76	0	0	0	3	0	0	0	3	69	13	2	2	1	0	0	87	166
14:30	70	18	1	5	0	0	1	95	0	0	0	5	0	0	0	5	63	12	1	4	1	0	1	82	182
14:45	61	12	2	7	1	0	0	83	0	1	0	2	0	0	0	3	65	12	2	6	2	0	0	87	173
1 Hr	254	50	7	29	3	8	1	352	0	1	0	14	0	0	0	15	252	48	7	15	5	1	1	329	696
15:00	62	12	0	7	3	2	1	87	0	0	2	3	0	0	0	5	75	10	1	6	2	0	0	94	186
15:15	80	15	2	5	1	1	0	104	0	0	0	5	0	0	0	5	66	15	4	4	1	0	0	90	199
15:30	91	11	3	9	2	0	0	116	0	0	0	1	0	0	0	1	72	14	1	3	1	0	1	92	209
15:45	73	15	2	8	0	2	0	100	0	0	0	3	0	0	0	3	68	10	0	4	0	0	0	82	185
1 Hr	306	53	7	29	6	5	1	407	0	0	2	12	0	0	0	14	281	49	6	17	4	0	1	358	779
16:00	80	26	4	4	3	1	0	118	0	0	0	5	0	0	0	5	62	17	1	2	3	0	0	85	208
16:15	80	8	0	5	3	0	0	96	1	0	0	2	0	0	0	3	74	25	1	4	1	0	0	105	204
16:30	96	22	1	2	2	0	0	123	0	3	0	0	0	0	0	3	75	15	4	8	1	0	0	103	229
16:45	79	27	4	5	3	0	0	118	0	0	0	0	0	0	0	0	87	17	1	2	0	2	0	109	227
1 Hr	335	83	9	16	11	1	0	455	1	3	0	7	0	0	0	11	298	74	7	16	5	2	0	402	868
17:00	95	20	3	3	0	8	0	129	0	0	0	0	0	0	0	0	98	27	4	4	1	3	0	137	266
17:15	81	33	2	5	1	0	0	122	0	0	0	0	0	0	0	0	91	14	1	4	1	0	1	112	234
17:30	101	25	1	2	0	0	1	130	0	0	0	0	0	0	0	0	61	11	1	2	3	0	0	78	208
17:45	80	24	4	2	0	4	0	114	0	0	0	0	0	0	0	0	90	13	3	5	0	1	0	112	226
1 Hr	357	102	10	12	1	12	1	495	0	0	0	0	0	0	0	0	340	65	9	15	5	4	1	439	934
18:00	74	15	3	2	3	1	0	98	0	0	0	0	0	0	0	0	72	15	2	5	0	1	0	95	193
18:15	85	15	4	2	0	0	0	106	0	0	0	0	0	0	0	0	54	11	0	0	0	2	0	67	173
18:30	82	12	0	0	0	0	1	95	0	0	0	0	0	0	0	0	62	14	0	1	0	0	0	77	172
18:45	63	18	2	1	1	0	0	85	0	0	0	0	0	0	0	0	59	10	2	6	0	0	0	77	162
1 Hr	304	60	9	5	4	1	1	384	0	0	0	0	0	0	0	0	247	50	4	12	0	3	0	316	700
Total	3126	722	116	256	66	34	6	4326	14	8	9	109	0	0	0	140	3109	712	126	230	63	19	6	4265	8731

APPENDIX 14-2

N15 / Quarry Access Priority Junction - AM Peak Hour

2024 AM Peak - Base Flows

From / To	N15 (north)	Quarry Access	N15 (south)	**Totals**
N15 (north)	0	10	488	**498**
Quarry Access	11	0	5	**16**
N15 (south)	412	7	0	**419**
Totals	**423**	**17**	**493**	**933**

2029 AM Peak - Base Flows + 8.08%

From / To	N15 (north)	Quarry Access	N15 (south)	**Totals**
N15 (north)	0	10	493	**503**
Quarry Access	11	0	5	**16**
N15 (south)	416	7	0	**423**
Totals	**427**	**17**	**498**	**942**

2039 AM Peak - Base Flows + 12.63%

From / To	N15 (north)	Quarry Access	N15 (south)	**Totals**
N15 (north)	0	10	493	**503**
Quarry Access	11	0	5	**16**
N15 (south)	416	7	0	**423**
Totals	**427**	**17**	**498**	**942**

N15 / Quarry Access Priority Junction - AM Peak Hour

2024 PM Peak - Base Flows

From / To	R445 (west)	Development access	R445 (east)	**Totals**
R445 (west)	0	2	451	**453**
Development access	2	0	10	**12**
R445 (east)	490	1	0	**491**
Totals	**492**	**3**	**461**	**956**

2029 PM Peak - Base Flows + 8.08%

From / To	R445 (west)	Development access	R445 (east)	**Totals**
R445 (west)	0	2	456	**458**
Development access	2	0	10	**12**
R445 (east)	495	1	0	**496**
Totals	**497**	**3**	**466**	**965**

2039 PM Peak - Base Flows + 12.63%

From / To	R445 (west)	Development access	R445 (east)	**Totals**
R445 (west)	0	2	456	**458**
Development access	2	0	10	**12**
R445 (east)	495	1	0	**496**
Totals	**497**	**3**	**466**	**965**

APPENDIX 14-3

Junctions 9

PICADY 9 - Priority Intersection Module

Version: 9.5.0.6896
© Copyright TRL Limited, 2018

For sales and distribution information, program advice and maintenance, contact TRL:
+44 (0)1344 379777 software@trl.co.uk www.trlsoftware.co.uk

The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: N15 - Roadstone Ballintra priority junction.j9
Path: S:\Jobs\2024\24171 Ballymagroarty Quarries, Ballintra, Donegal EIAR\24171-01\Reports\Working\PICADY
Report generation date: 29/10/2024 09:43:49

»2024, AM
»2024, PM
»2029, AM
»2029, PM
»2039, AM
»2039, PM

Summary of junction performance

	AM				PM			
	Queue (Veh)	Delay (s)	RFC	LOS	Queue (Veh)	Delay (s)	RFC	LOS
	2024							
Stream B-AC	0.1	10.51	0.05	B	0.0	7.93	0.03	A
Stream C-AB	0.0	4.74	0.02	A	0.0	4.43	0.00	A
	2029							
Stream B-AC	0.1	10.56	0.05	B	0.0	7.96	0.03	A
Stream C-AB	0.0	4.73	0.02	A	0.0	4.42	0.00	A
	2039							
Stream B-AC	0.1	10.56	0.05	B	0.0	7.96	0.03	A
Stream C-AB	0.0	4.73	0.02	A	0.0	4.42	0.00	A

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	
Location	
Site number	
Date	29/10/2024
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ROADPLAN01\jbyrne
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024	AM	ONE HOUR	07:45	09:15	15	✓
D2	2024	PM	ONE HOUR	16:15	17:45	15	✓
D3	2029	AM	ONE HOUR	07:45	09:15	15	✓
D4	2029	PM	ONE HOUR	16:15	17:45	15	✓
D5	2039	AM	ONE HOUR	07:45	09:15	15	✓
D6	2039	PM	ONE HOUR	16:15	17:45	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

2024, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description	Arm type
A	untitled		Major
B	untitled		Minor
C	untitled		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right turn bay	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	9.80			250.0	✓	0.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.50	45	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Junction	Stream	Intercept (Veh/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
1	B-A	543	0.083	0.209	0.131	0.298
1	B-C	688	0.088	0.223	-	-
1	C-B	719	0.232	0.232	-	-

The slopes and intercepts shown above do NOT include any corrections or adjustments.

Streams may be combined, in which case capacity will be adjusted.

Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2024	AM	ONE HOUR	07:45	09:15	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	498	100.000
B		ONE HOUR	✓	16	100.000
C		ONE HOUR	✓	419	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	10	488
	B	11	0	5
	C	412	7	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.05	10.51	0.1	B	15	22
C-AB	0.02	4.74	0.0	A	13	19
C-A					372	558
A-B					9	14
A-C					448	672

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	414	0.029	12	0.0	0.0	8.947	A
C-AB	9	2	769	0.011	9	0.0	0.0	4.734	A
C-A	307	77			307				
A-B	8	2			8				
A-C	367	92			367				

08:00 - 08:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	392	0.037	14	0.0	0.0	9.541	A
C-AB	12	3	795	0.015	12	0.0	0.0	4.593	A
C-A	365	91			365				
A-B	9	2			9				
A-C	439	110			439				

08:15 - 08:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	360	0.049	18	0.0	0.1	10.507	B
C-AB	17	4	834	0.020	17	0.0	0.0	4.406	A
C-A	444	111			444				
A-B	11	3			11				
A-C	537	134			537				

08:30 - 08:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	360	0.049	18	0.1	0.1	10.509	B
C-AB	17	4	834	0.020	17	0.0	0.0	4.408	A
C-A	444	111			444				
A-B	11	3			11				
A-C	537	134			537				

08:45 - 09:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	392	0.037	14	0.1	0.0	9.544	A
C-AB	12	3	795	0.015	12	0.0	0.0	4.596	A
C-A	365	91			365				
A-B	9	2			9				
A-C	439	110			439				

09:00 - 09:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	414	0.029	12	0.0	0.0	8.952	A
C-AB	9	2	769	0.012	9	0.0	0.0	4.736	A
C-A	307	77			307				
A-B	8	2			8				
A-C	367	92			367				

2024, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2024	PM	ONE HOUR	16:15	17:45	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	453	100.000
B		ONE HOUR	✓	12	100.000
C		ONE HOUR	✓	491	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	2	451
	B	2	0	10
	C	490	1	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.03	7.93	0.0	A	11	17
C-AB	0.00	4.43	0.0	A	2	3
C-A					449	673
A-B					2	3
A-C					414	621

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	510	0.018	9	0.0	0.0	7.186	A
C-AB	1	0.34	814	0.002	1	0.0	0.0	4.431	A
C-A	368	92			368				
A-B	2	0.38			2				
A-C	340	85			340				

16:30 - 16:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	492	0.022	11	0.0	0.0	7.479	A
C-AB	2	0.47	849	0.002	2	0.0	0.0	4.250	A
C-A	440	110			440				
A-B	2	0.45			2				
A-C	405	101			405				

16:45 - 17:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	467	0.028	13	0.0	0.0	7.933	A
C-AB	3	0.69	900	0.003	3	0.0	0.0	4.013	A
C-A	538	134			538				
A-B	2	0.55			2				
A-C	497	124			497				

17:00 - 17:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	467	0.028	13	0.0	0.0	7.933	A
C-AB	3	0.69	900	0.003	3	0.0	0.0	4.014	A
C-A	538	134			538				
A-B	2	0.55			2				
A-C	497	124			497				

17:15 - 17:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	492	0.022	11	0.0	0.0	7.482	A
C-AB	2	0.47	849	0.002	2	0.0	0.0	4.251	A
C-A	440	110			440				
A-B	2	0.45			2				
A-C	405	101			405				

17:30 - 17:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	510	0.018	9	0.0	0.0	7.189	A
C-AB	1	0.35	814	0.002	1	0.0	0.0	4.431	A
C-A	368	92			368				
A-B	2	0.38			2				
A-C	340	85			340				

2029, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2029	AM	ONE HOUR	07:45	09:15	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	503	100.000
B		ONE HOUR	✓	16	100.000
C		ONE HOUR	✓	423	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	10	493
	B	11	0	5
	C	416	7	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.05	10.56	0.1	B	15	22
C-AB	0.02	4.73	0.0	A	13	19
C-A					376	563
A-B					9	14
A-C					452	679

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	413	0.029	12	0.0	0.0	8.971	A
C-AB	9	2	770	0.012	9	0.0	0.0	4.727	A
C-A	310	77			310				
A-B	8	2			8				
A-C	371	93			371				

08:00 - 08:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	390	0.037	14	0.0	0.0	9.576	A
C-AB	12	3	797	0.015	12	0.0	0.0	4.585	A
C-A	368	92			368				
A-B	9	2			9				
A-C	443	111			443				

08:15 - 08:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	358	0.049	18	0.0	0.1	10.559	B
C-AB	17	4	836	0.020	17	0.0	0.0	4.396	A
C-A	449	112			449				
A-B	11	3			11				
A-C	543	136			543				

08:30 - 08:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	358	0.049	18	0.1	0.1	10.562	B
C-AB	17	4	836	0.020	17	0.0	0.0	4.396	A
C-A	449	112			449				
A-B	11	3			11				
A-C	543	136			543				

08:45 - 09:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	390	0.037	14	0.1	0.0	9.579	A
C-AB	12	3	797	0.015	12	0.0	0.0	4.587	A
C-A	368	92			368				
A-B	9	2			9				
A-C	443	111			443				

09:00 - 09:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	413	0.029	12	0.0	0.0	8.978	A
C-AB	9	2	770	0.012	9	0.0	0.0	4.727	A
C-A	310	77			310				
A-B	8	2			8				
A-C	371	93			371				

2029, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2029	PM	ONE HOUR	16:15	17:45	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	458	100.000
B		ONE HOUR	✓	12	100.000
C		ONE HOUR	✓	496	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	2	456
	B	2	0	10
	C	495	1	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.03	7.96	0.0	A	11	17
C-AB	0.00	4.42	0.0	A	2	3
C-A					453	680
A-B					2	3
A-C					418	628

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	509	0.018	9	0.0	0.0	7.200	A
C-AB	1	0.35	815	0.002	1	0.0	0.0	4.422	A
C-A	372	93			372				
A-B	2	0.38			2				
A-C	343	86			343				

16:30 - 16:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	491	0.022	11	0.0	0.0	7.497	A
C-AB	2	0.47	851	0.002	2	0.0	0.0	4.239	A
C-A	444	111			444				
A-B	2	0.45			2				
A-C	410	102			410				

16:45 - 17:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	465	0.028	13	0.0	0.0	7.960	A
C-AB	3	0.70	903	0.003	3	0.0	0.0	4.000	A
C-A	543	136			543				
A-B	2	0.55			2				
A-C	502	126			502				

17:00 - 17:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	465	0.028	13	0.0	0.0	7.960	A
C-AB	3	0.70	903	0.003	3	0.0	0.0	4.002	A
C-A	543	136			543				
A-B	2	0.55			2				
A-C	502	126			502				

17:15 - 17:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	491	0.022	11	0.0	0.0	7.498	A
C-AB	2	0.47	851	0.002	2	0.0	0.0	4.240	A
C-A	444	111			444				
A-B	2	0.45			2				
A-C	410	102			410				

17:30 - 17:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	509	0.018	9	0.0	0.0	7.201	A
C-AB	1	0.35	815	0.002	1	0.0	0.0	4.422	A
C-A	372	93			372				
A-B	2	0.38			2				
A-C	343	86			343				

2039, AM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.25	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2039	AM	ONE HOUR	07:45	09:15	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	503	100.000
B		ONE HOUR	✓	16	100.000
C		ONE HOUR	✓	423	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	10	493
	B	11	0	5
	C	416	7	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.05	10.56	0.1	B	15	22
C-AB	0.02	4.73	0.0	A	13	19
C-A					376	563
A-B					9	14
A-C					452	679

Main Results for each time segment

07:45 - 08:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	413	0.029	12	0.0	0.0	8.971	A
C-AB	9	2	770	0.012	9	0.0	0.0	4.727	A
C-A	310	77			310				
A-B	8	2			8				
A-C	371	93			371				

08:00 - 08:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	390	0.037	14	0.0	0.0	9.576	A
C-AB	12	3	797	0.015	12	0.0	0.0	4.585	A
C-A	368	92			368				
A-B	9	2			9				
A-C	443	111			443				

08:15 - 08:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	358	0.049	18	0.0	0.1	10.559	B
C-AB	17	4	836	0.020	17	0.0	0.0	4.396	A
C-A	449	112			449				
A-B	11	3			11				
A-C	543	136			543				

08:30 - 08:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	18	4	358	0.049	18	0.1	0.1	10.562	B
C-AB	17	4	836	0.020	17	0.0	0.0	4.396	A
C-A	449	112			449				
A-B	11	3			11				
A-C	543	136			543				

08:45 - 09:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	14	4	390	0.037	14	0.1	0.0	9.579	A
C-AB	12	3	797	0.015	12	0.0	0.0	4.587	A
C-A	368	92			368				
A-B	9	2			9				
A-C	443	111			443				

09:00 - 09:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	12	3	413	0.029	12	0.0	0.0	8.978	A
C-AB	9	2	770	0.012	9	0.0	0.0	4.727	A
C-A	310	77			310				
A-B	8	2			8				
A-C	371	93			371				

2039, PM

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Major road direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	untitled	T-Junction	Two-way		0.11	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2039	PM	ONE HOUR	16:15	17:45	15	✓

Default vehicle mix	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)
✓	✓	✓	HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
A		ONE HOUR	✓	458	100.000
B		ONE HOUR	✓	12	100.000
C		ONE HOUR	✓	496	100.000

Origin-Destination Data

Demand (Veh/hr)

		To		
		A	B	C
From	A	0	2	456
	B	2	0	10
	C	495	1	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		A	B	C
From	A	10	10	10
	B	10	10	10
	C	10	10	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)
B-AC	0.03	7.96	0.0	A	11	17
C-AB	0.00	4.42	0.0	A	2	3
C-A					453	680
A-B					2	3
A-C					418	628

Main Results for each time segment

16:15 - 16:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	509	0.018	9	0.0	0.0	7.200	A
C-AB	1	0.35	815	0.002	1	0.0	0.0	4.422	A
C-A	372	93			372				
A-B	2	0.38			2				
A-C	343	86			343				

16:30 - 16:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	491	0.022	11	0.0	0.0	7.497	A
C-AB	2	0.47	851	0.002	2	0.0	0.0	4.239	A
C-A	444	111			444				
A-B	2	0.45			2				
A-C	410	102			410				

16:45 - 17:00

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	465	0.028	13	0.0	0.0	7.960	A
C-AB	3	0.70	903	0.003	3	0.0	0.0	4.000	A
C-A	543	136			543				
A-B	2	0.55			2				
A-C	502	126			502				

17:00 - 17:15

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	13	3	465	0.028	13	0.0	0.0	7.960	A
C-AB	3	0.70	903	0.003	3	0.0	0.0	4.002	A
C-A	543	136			543				
A-B	2	0.55			2				
A-C	502	126			502				

17:15 - 17:30

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	11	3	491	0.022	11	0.0	0.0	7.498	A
C-AB	2	0.47	851	0.002	2	0.0	0.0	4.240	A
C-A	444	111			444				
A-B	2	0.45			2				
A-C	410	102			410				

17:30 - 17:45

Stream	Total Demand (Veh/hr)	Junction Arrivals (Veh)	Capacity (Veh/hr)	RFC	Throughput (Veh/hr)	Start queue (Veh)	End queue (Veh)	Delay (s)	Unsignalised level of service
B-AC	9	2	509	0.018	9	0.0	0.0	7.201	A
C-AB	1	0.35	815	0.002	1	0.0	0.0	4.422	A
C-A	372	93			372				
A-B	2	0.38			2				
A-C	343	86			343				