Figure 11-7: NIAH Garden survey within 2km of proposed quarry extension site.

11.8.2.4 Historic Mapping

The available historic mapping for the proposed development area was consulted for items of potential cultural heritage merit which may be shown therein but which may not appear in lists of Protected Structures or the NIAH. The 1st (1840s) and 2nd (1900s) edition OS maps for the area were also

consulted, in particular for items of cultural heritage merit that may not be included in the Record of Monuments and Places, lists of Protected Structures or NIAH. Items of local cultural heritage significance such as lime kilns, vernacular structures and other features are often depicted on these maps. On the 1st edition map the proposed development area is relatively featureless apart from a number of field boundaries. The 2nd Edition maps shows an open area with the field boundaries having been removed.

Figure 11-8: Proposed quarry extension overlaid on 1st edition (1840s) OS map

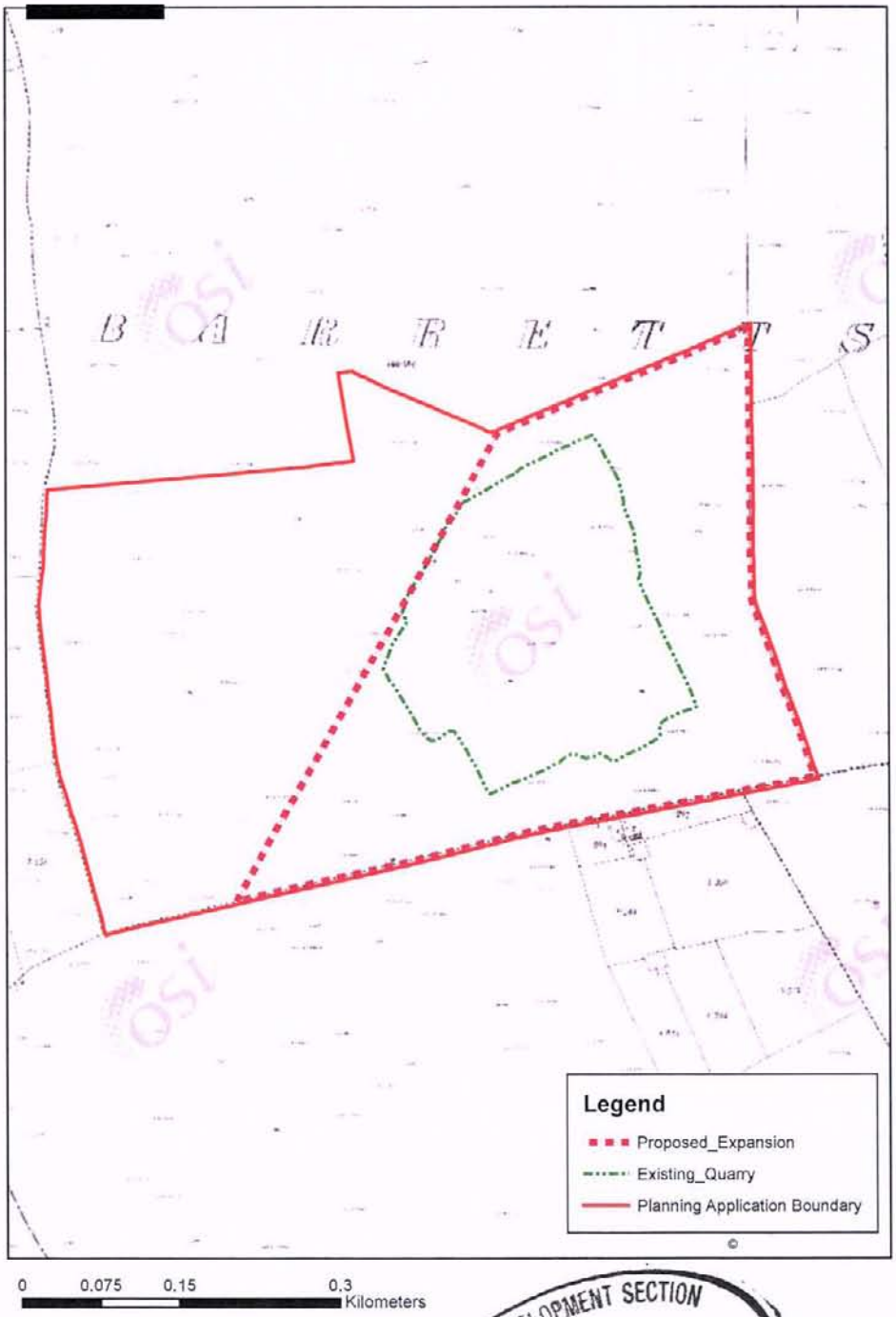

Figure 11-9: Proposed development overlaid on 2nd edition (1900s) OS map.

11.9 Potential Impacts and Mitigation Measures

11.9.1 Construction Phase Potential Impacts (Direct)

Direct Impact refers to a 'physical impact' on a monument or site. The construction phase of a development may consist of earthmoving activities such as topsoil removal in advance of quarrying. This may have a number of potential negative impacts on the known and potential archaeological heritage. These are outlined below with the suggested mitigation measures.

11.9.1.1 National Monuments

No National Monuments are located on or in close proximity to the proposed development site, therefore no direct impacts to such monuments will occur.

11.9.1.2 Recorded Monuments

No direct (physical) impacts on the Recorded Monuments listed in this report will occur as none are located within the footprint of the proposed development or within close proximity.

11.9.1.3 Other potential archaeological sites

No above-ground newly recorded sites were noted during fieldwork within the footprint of the proposed development either when originally examined as part of the EIS in 2006 and 2009 or during the current assessment. The discovery of such monuments is negated by the fact that the site is largely occupied by an existing quarry and already reduced to natural strata.

11.9.1.4 Sub-surface archaeological potential

All previous quarry activities were archaeologically monitored (see section 11.8.1.6 above) and did not result in the discovery of any archaeological finds, features or deposits. In this regard the archaeological potential of the extension to the existing quarry is low with the expansion areas already reduced to natural strata.

11.9.1.5 Architectural Heritage

Architectural heritage sites and features of cultural heritage potential such as gardens and designed landscapes in the vicinity of the site were considered in this report. No Protected structures or NIAH structures are located either within or adjacent to the proposed quarry extension. No such features will be directly impacted by the proposed development therefore.

11.9.2 Operational Phase Potential Impacts (Indirect)

Indirect impacts are where a feature or site of archaeological, architectural heritage merit or their setting is located in close proximity to a proposed development. Indirect impacts here are mainly concerned with impacts on setting of cultural heritage sites.

Impacts on settings of sites may arise when a development is proposed immediately adjacent to a recorded monument or cluster of monuments. While the proposed development may not physically impact on a site, it may alter the setting of a monument or group of monuments. There is no standardised industry-wide approach for assessing the degree of impact to the setting of a monument. For purposes of assessing visual impact on setting, the uniqueness of the monuments, the potential interrelationships of monuments, the inter-visibility of monuments, visual dominance and whether a setting is altered or unaltered can be used to assess impact. The nature and dominance of the proposed

development is also taken into consideration and the topography within which the development is located. The proposed development in this instance is regarded as low visibility since its activities are below ground. The quarry and its ancillary activities are regarded as low visibility and are not significantly visible in the landscape. For example the N6 embankment to the south is such that the quarry cannot be viewed from the south in the wider setting. The surrounding landscape has the capacity to accommodate an extension to the existing quarry without visual impact as the present quarry and its ancillary activities are already part of the existing landscape.

11.9.2.1 National Monuments

National Monuments within 10km were considered in this report for purposes of ascertaining potential impact on visual setting of the monuments. The distance of the monuments, together with the nature of the proposed development is such that the settings of the monuments will not be impacted by this proposed development.

11.9.2.2 Recorded Monuments within 2km

The potential indirect impacts are assessed, not by visiting individual sites on private land, but rather assessing the nature and type of the monuments (levelled/extant), dominant/low-visibility, the distance of the monument from the proposed quarry site and therefore the likely potential impact on the setting of the monument. Monuments that are levelled or with very little remaining surface trace are not capable of having their 'visual setting' impacted and therefore have negligible indirect impacts. Since only three RMPs sites are located within 1km of the proposed quarry and the site is largely existing the potential impacts on setting as a result of the quarry extension are considered to be imperceptible.

11.9.2.3 Protected Structures and NIAH sites

Similar to the recorded monuments in the vicinity of the proposed development site, visibility of the proposed development is likely to be intermittent if not fully screened by existing boundaries and vegetation. Because there are no RPS or NIAH structures within or adjacent to the proposed quarry extension, no negative effects on setting of the architectural heritage resource will occur.

11.10 Mitigation Measures

11.10.1 Potential sub-surface archaeology within the site boundary

The artefact bearing potential of the sub soil and the potential for finding sub-surface archaeological deposits is considered to be low. Archaeological monitoring of all topsoil removal took place in 2007 when construction began within the quarry. No archaeological finds, features or deposits were uncovered. In this regard, since topsoil has been removed from the area of the proposed extension there is no requirement for mitigation measures.

11.11 Do Nothing Scenario

If the development were not to proceed, the potential impacts on heritage assets as a result of the proposed quarry extension would not apply with no need for mitigation.

11.12 Worst Case Scenario

The Worst Case Scenario would be if the development were to proceed without implementing mitigation measures. Since no mitigation measures are necessary it is not anticipated that the development would have any adverse impacts (direct or indirect) on the cultural heritage resource.

11.13 Cumulative Impacts

Cumulative impact is defined as '*The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.*' (Guidelines on the Information to be Contained in Environmental Impact Assessment Reports 2017, 52). Cumulative impacts encompass the combined effects of multiple developments or activities on a range of receptors. In this case the receptors are the archaeological monuments and architectural/cultural heritage sites in the immediate vicinity of the proposed development. Cumulative Impacts at both the construction stage and the operational stage are discussed.

Operational Stage

Since no profound or significant impacts on setting were identified as part of the current proposal, the addition of other projects in the vicinity would not likely result in cumulative impacts.

Construction Stage:

In general, the potential cumulative **direct impacts** on archaeology and cultural heritage could increase when considering additional projects in the vicinity. However, if suitable mitigation is implemented for such projects then direct impacts on archaeology (known and unknown) are likely to be imperceptible.

11.14 Decommissioning Phase

There will be no significant potential impacts on the archaeological, architectural and cultural heritage environment during the decommissioning of the development.

11.15 Conclusion

This report comprises an assessment of the potential impact of a proposed quarry extension at Barrettspark townland near Athenry, County Galway. The impacts on the archaeological and architectural landscape were assessed. The assessment was based on desktop research, field survey as well as GIS.

No National Monuments, recorded monuments (RMP), NIAH, RPS or previously unrecorded (above-ground) monuments are located within or immediately adjacent to the site application boundary. No direct impact on the known Cultural Heritage resources will therefore occur. Sub-surface archaeological potential within the site is deemed to have already been assessed through archaeological monitoring of topsoil removal when quarry activities began (See section 11.8.1.6 above). The proposed expansion area has been reduced to natural strata with topsoil removed and therefore impacts on sub-surface sites will not occur.

National Monuments within 10km of the site were assessed with the potential indirect impacts identified as imperceptible. Thirty-five RMP sites are located within 2km of the proposed development site with only three within 1km. The potential effects on the monuments in the 2km study area are considered to be imperceptible due to the presence of an existing quarry in the landscape and the nature of the proposed works (i.e. below ground). The landscape in which the proposed development site is located has the capacity to absorb the quarry extension without noticeable effects. Mitigation measures are not deemed necessary therefore.

11.16 References

- Architectural Heritage Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government) 2004.
- Aalen, F.H.A. et al., 1997, Atlas of the Irish Rural Landscape. Cork University Press, Cork.
- Department of Arts, Heritage, Gaeltacht and the Islands, 1999, Framework and Principles for the Protection of the Archaeological Heritage, 1999.
- Galway County Development Plan 2015-2021, Galway County Council.
- Guidelines on the information to be contained in Environmental Impact Statements, EPA 2002.
- Revised Guidelines on the Information to be contained in Environmental Impact Statements Draft September 2015.
- Advice Notes for Preparing Environmental Impact Statements Draft September 2015.

- **Other Sources**
- Record of Monuments and Places (RMP) for County Galway
- 1st Edition 6 inch OS maps (1840s).
- 2nd Edition 25 inch OS maps (1900s)
- www.webgis.archaeology.ie/historicenvironment
- www.excavations.ie

12. MATERIAL ASSETS

12.1 Traffic and Transport

12.1.1 Introduction

12.1.1.1 Purpose of Section

The purpose of this section is to assess the traffic effects of additional traffic movements that will be generated on the surrounding road network due to the proposed Coshla Quarry Extension. The site of the quarry is located in the townland of Barrettspark, Athenry, County Galway.

12.1.1.2 Statement of Authority

This section of the EIAR has been prepared by Alan Lipscombe of Alan Lipscombe Traffic and Transport Consultants. Alan is a competent expert in traffic and transport assessments. In 2007 Alan set up a traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the Senior Transportation Engineer for the Galway Land Use and Transportation Study. Since the completion of that study in 1999, Alan has worked throughout the West of Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II, cost benefit analyses (COBA) and various studies for the NUI Galway. Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for CBP throughout the UK, Malta and Indonesia. He has particular expertise in the assessment of development related traffic including various quarries.

12.1.1.3 Guidance and Legislation

This section of the EIAR has been completed in accordance with the guidance set out in Chapter 1. The assessment uses standard terminology to describe the likely significant effects associated with the proposed development. Further information on the classification of effects used in this assessment is presented in Section 1.8.2 of this EIAR.

12.1.2 Method and Section Structure

The report adopts the guidance for such assessments set out by Transport Infrastructure Ireland (TII), in the document *'Guidelines for Traffic and Transport Assessments, May 2014'.*

The Traffic and Transport Section of this report is set out as follows:

- Section 12.1.3 – Receiving Environment,
- Section 12.1.4 – Traffic Effects of Coshla Quarry Extension
- Section 12.1.5 – Provision for Sustainable Modes of Transport,
- Section 12.1.6 – Likely and Significant Impacts and Associated Mitigation Measures.

12.1.3 Receiving Environment

12.1.3.1 Site Location and Network Summary

The location of the existing Coshla Quarry is shown in the context of the national and regional highway networks in Figure 12.1.

The R339 Monivea Road connects with the L-7109 by means of a priority junction, with the latter forming the minor arm. The R339 Monivea Road serves as a radial route to / from Galway City and the M6 motorway.

The section of the L-7109 leading to the Coshla Quarry is generally straight and has sufficient width for 2 vehicles to pass. The existing access junction serving the Coshla Quarry off the local L-7109 Road is located approximately 1 km south of the junction with the R339 Monivea Road.

Visibility for traffic exiting the L-7109 onto the R339 is adequate in both directions, as shown in Plates 12.1 and 12.2. This is discussed further in Section 12.1.4.

Both the R339 Monivea Road and the section of the local L-7109 on the delivery route have designated speed limits of 80 kilometres per hour (kph). The existing road network is shown in Plates 12.1 to 12.6.

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 12.1 Site location

PROJECT:	Coshla Quarry Extension		
CLIENT:	Coshla Quarry Ltd	SCALE:	NTS
PROJECT NO: 6260	DATE: 10.01.20	DRAWN BY:	AL

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Plate 12-1 Looking east along the R339 Monivea Road taken from the junction with L7109

Plate 12-2 Looking west along the R339 Monivea Road taken from the junction with L7109

Plate 12-3 Looking south along the L7109 taken from the junction with the R339 Monivea Road

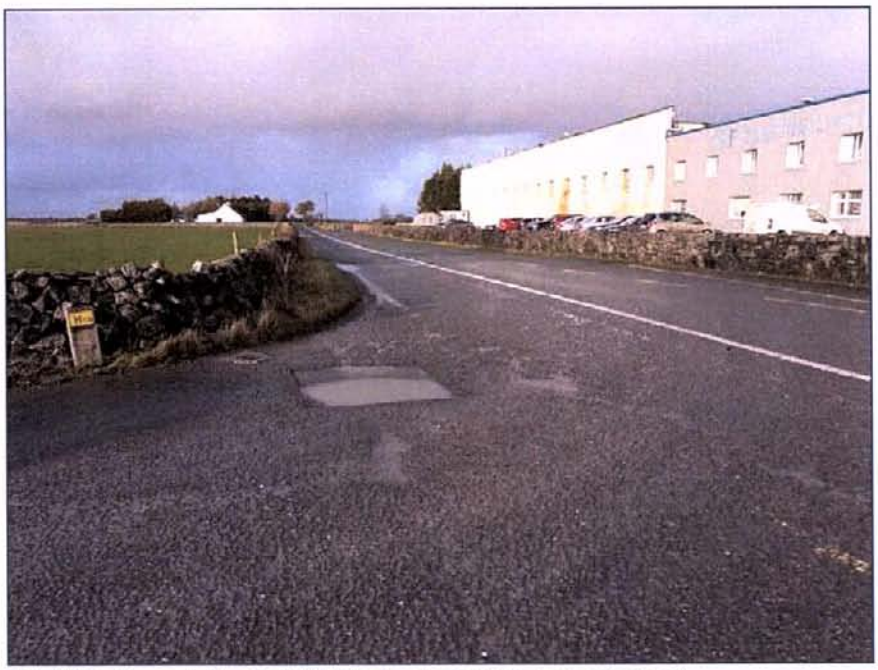


Plate 12-4 Looking north along the L7109 taken from the Coshla Quarry access junction

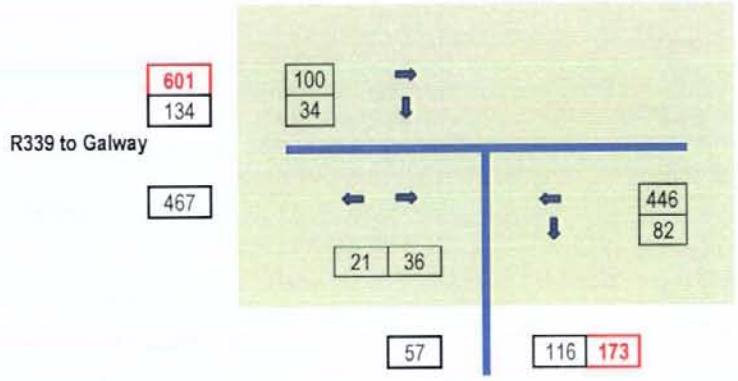
Plate 12-5 Looking south along the L7109 taken from the Coshla Quarry access junction

Plate 12-6 Looking west along the Coshla Quarry access road taken from the junction with the L7109

12.1.3.2 Existing Traffic Volumes

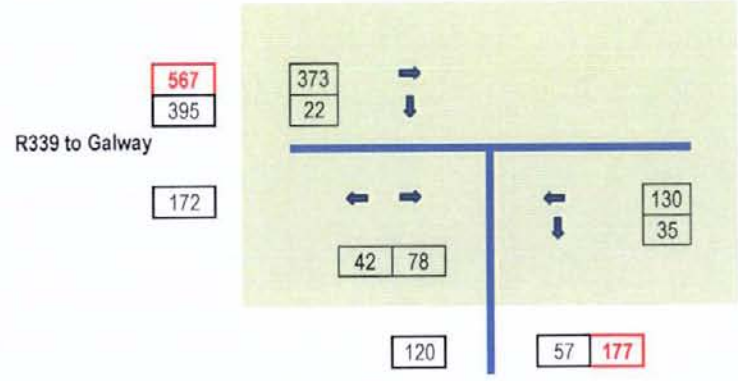
A peak period classified turning count was undertaken at the R339 / L-7109 junction on Tuesday 4th September, 2018, with the turning movements shown in terms of pcus (passenger car equivalent units) in Figure 12.2. The main points to note are as follows;

- The AM peak hour was observed to be 07:30 to 08:30 with the PM peak hour 16:15 to 17:15.
- In terms of 2-way traffic volumes the AM and PM peak hours were observed to carry similar volumes with 664 pcus and 616 pcus observed on the R339 Monivea Road during the AM and PM hours respectively, and 173 and 177 pcus observed on the L-7109 during the same hours.
- As would be expected the traffic flows observed on the R339 are tidal in nature, with the dominant direction of flow (80%) westbound into Galway during the AM peak hour, and eastbound out of town (73%) during the PM peak hour.



Observed traffic flows
September 2018
AM peak hour (07:30 - 08:30)
Existing development

Flows in pcus



Observed traffic flows
September 2018
PM peak hour (16:15 - 17:15)
Existing development

Flows in pcus

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Figure 12.2 Observed traffic flows, AM and PM peak hours, September 2018, existing development

A full listing of the traffic count undertaken by Traffinomics Ltd is provided as Appendix 12-1.

In order to take account of seasonal variations in traffic levels automatic traffic count data maintained by TII on the N6 was used to determine variations in flows by month. It was established that traffic volumes in the busiest month of August were recorded to be 4% higher than those observed in the month of September when the observations were made. Year 2018 September flows were therefore seasonally adjusted by +4%, as set out in Table 12.1 and Figure 12.3. The TII automatic count data is included as Appendix 12.2.

Table 12-1 Observed and seasonally adjusted traffic flows, R338/L7109 junction, by time period, year 2018

Link	Observed September		Seasonally adjusted	
	AM peak hour	PM peak hour	AM peak hour	PM peak hour
R338 (east)	664	616	691	641
L7109 (to quarry)	173	177	180	184
R338 (west)	601	567	625	590

12.1.3.3 Future Year Traffic Volumes

With an assumed opening year for the quarry extension of 2021, in line with guidance for such assessments set out by TII in the document PE-PDV-02045-01 *'Traffic and Transport Assessment Guideliness, May 2014'*, a future year of +15 years was also assessed. With an opening year of 2021 the future year for the purpose of this assessment is therefore the year 2036.

Opening year 2021 and future year 2036 traffic flows were determined from the 2018 seasonally adjusted traffic flows by applying an annual growth factor determined from TII's Project Appraisal Guidelines for National Roads Unit 5.3, Table 5.3.2. Annual growth indices and derived growth rates are set out in Tables 12.2 and 12.3 with traffic flows forecast to grow by 8% between the years 2018 to 2021, and by 43.0% between the years 2018 and 2036. It is noted that future year background traffic forecasts are based on growth factors for light vehicles (cars and lgvs) as this category accounts for the majority of traffic on the surrounding road network (97% on the R339 and 83% on the L7109).

Based on the above, traffic forecasts for the opening year 2021 and future year 2036 are shown in terms of pcus in Figures 12.4 and 12.5.

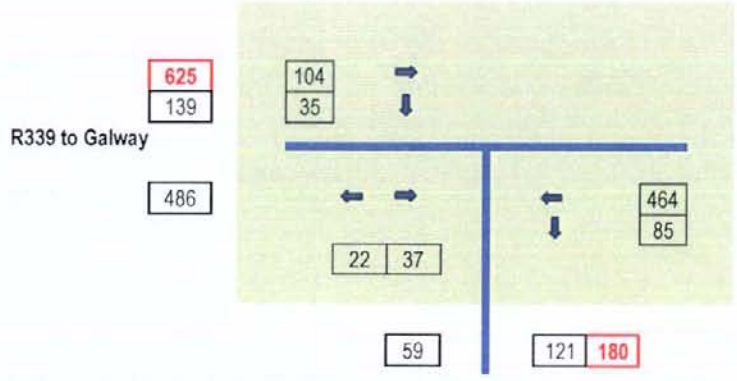
Table 12-2 TII Traffic growth indices, light vehicles (County Galway)

Year	Lights - Annual factor			Lights - Cumulative index		
	Low	Medium	High	Low	Medium	High
2018	1.0243	1.0259	1.0294	1.000	1.000	1.000
2019	1.0243	1.0259	1.0294	1.024	1.026	1.029

Year	Lights - Annual factor			Lights - Cumulative index		
	Low	Medium	High	Low	Medium	High
2020	1.0243	1.0259	1.0294	1.049	1.052	1.060
2021	1.0243	1.0259	1.0294	1.075	1.080	1.091
2022	1.0243	1.0259	1.0294	1.101	1.108	1.123
2023	1.0243	1.0259	1.0294	1.128	1.136	1.156
2024	1.0243	1.0259	1.0294	1.155	1.166	1.190
2025	1.0243	1.0259	1.0294	1.183	1.196	1.225
2026	1.0243	1.0259	1.0294	1.212	1.227	1.261
2027	1.0243	1.0259	1.0294	1.241	1.259	1.298
2028	1.0243	1.0259	1.0294	1.271	1.291	1.336
2029	1.0243	1.0259	1.0294	1.302	1.325	1.375
2030	1.0087	1.0109	1.0148	1.314	1.339	1.396
2031	1.0087	1.0109	1.0148	1.325	1.354	1.416
2032	1.0087	1.0109	1.0148	1.337	1.369	1.437
2033	1.0087	1.0109	1.0148	1.348	1.384	1.459
2034	1.0087	1.0109	1.0148	1.360	1.399	1.480
2035	1.0087	1.0109	1.0148	1.372	1.414	1.502
2036	1.0087	1.0109	1.0148	1.384	1.429	1.524
2037	1.0087	1.0109	1.0148	1.396	1.445	1.547

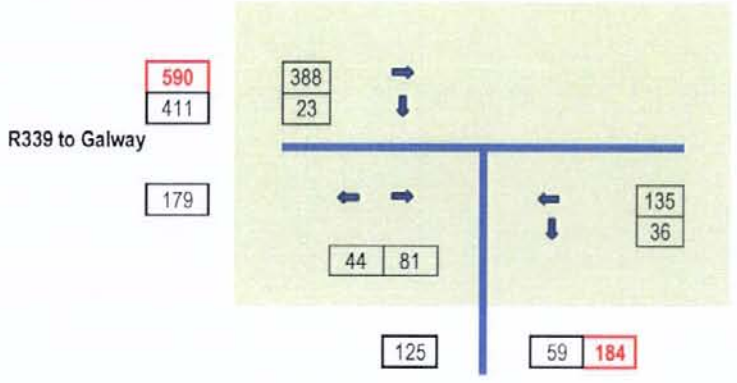
Table 12-3 TII derived growth rates

Period	Factor		
	low	Medium	High
2018- 2021	1.07	1.08	1.09
2018- 2036	1.38	1.43	1.52



Observed traffic flows
Seasonally adjusted 2018
AM peak hour (07:30 - 08:30)
Existing development

Flows in pcus



Observed traffic flows
Seasonally adjusted 2018
PM peak hour (16:15 - 17:15)
Existing development

Flows in pcus

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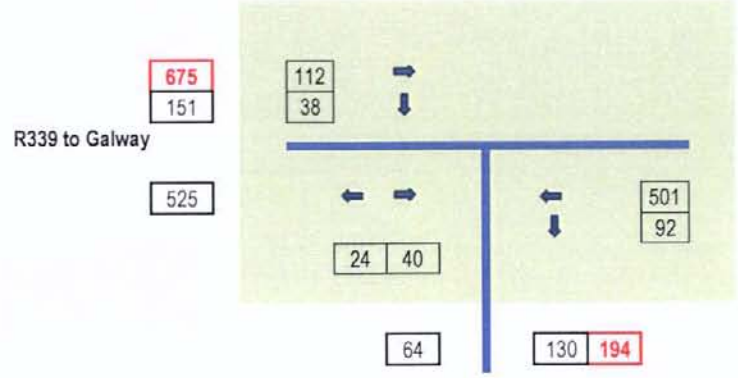
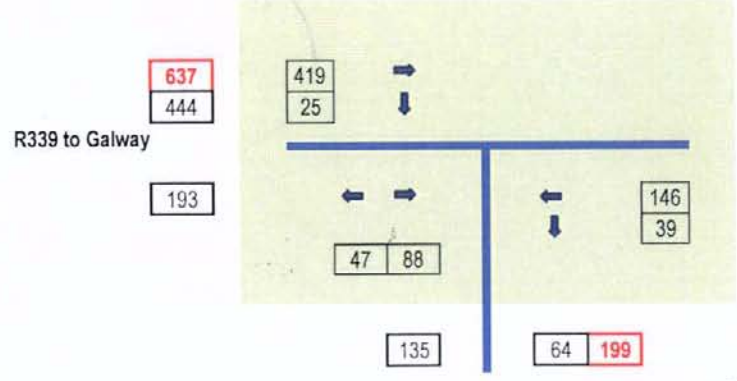
Figure 12.3 Observed traffic flows, AM and PM peak hours, seasonally adjusted 2018, existing development



Background traffic year 2021
AM peak hour (07:30 - 08:30)
Existing development

Flows in pcus



Background traffic year 2021
PM peak hour (16:15 - 17:15)
Existing development

Flows in pcus

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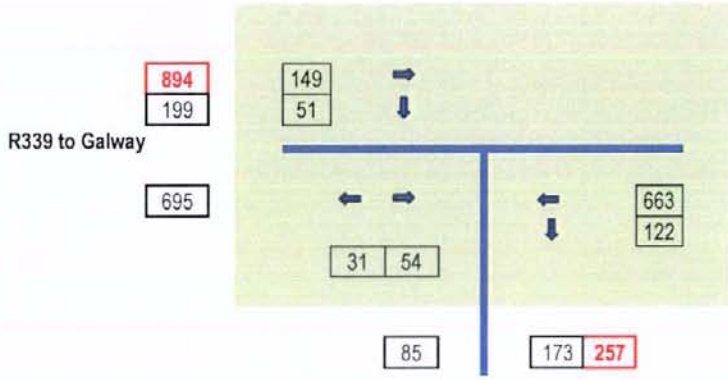
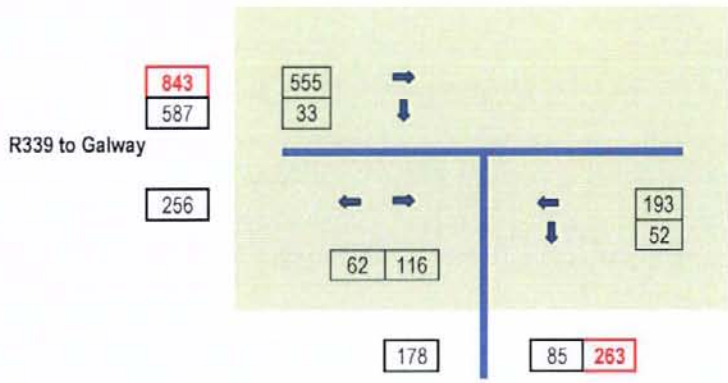
Figure 12.4 Background traffic flows, AM and PM peak hours, Opening year 2021 existing development



Background traffic year 2036
AM peak hour (07:30 - 08:30)
Existing development

Flows in pcus



Background traffic year 2036
PM peak hour (16:15 - 17:15)
Existing development

Flows in pcus

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Figure 12.5 Background traffic flows, AM and PM peak hours, Future year 2036, existing development

12.1.3.4 Road Safety of Existing Network

It is noted from the collision database maintained by the Road Safety Authority, with an extract included as Appendix 12.3, that there were no vehicle collisions at the R339 / L-7109 junction or the Coshla Quarry access junction on the L-7109 during the 12 year period from the years 2005 to 2016 inclusive. This would indicate that the local road network has operated relatively safely during this period.

12.1.3.5 Trip Generation of Proposed Quarry Extension

The details of the proposed Coshla Quarry Extension are provided in Chapter 3 of this EIAR.

Current planning conditions limit quarry HGV movements to a maximum of 50 two way movements per day. From information provided by Coshla Quarries Ltd it was determined that an average of 47 heavy goods vehicle (HGV) movements are currently generated to and from the site on a daily basis. The daily flow profile and together with the movements generated per hour are shown in Table 12.4.

In order to extract the available material in the quarry within the requested 20-year planning permission the applicant requires an increase in the number of permissible HGV movements to and from the quarry. It In order to extract the material from the quarry within 20 years it was assumed that double the amount of HGV movement that are currently generated by the existing quarry will be generated by the extension, as set out in Table 12.5. Under this scenario the average daily two-way HGV trips would be 139. The figures show that for the scenario tested the 2 – way HGV movements will increase as a result of the proposed quarry extension from 4 to 11 HGV movements during the AM peak hour, and from 7 to 20 HGV movements during the PM peak hour. It is not anticipated that the number of staff employed on the site will increase with the proposed extension.

The additional HGV movements were then all assumed to travel through the R339 / L-7109 junction and were distributed based on the HGV movements observed passing through the junction from the traffic count as shown in Figure 12.6. In this figure it is demonstrated that during the AM peak hour HGV movements are weighted to / from the east by 75% / 25% for both those arriving and departing. The same is the case for HGVs arriving to the site during the PM peak hour, while those leaving the site during the PM peak hour are split 60% / 40% with the majority travelling in the direction of Galway. The forecast additional HGV movements generated by the proposed Coshla Quarry Extension are shown in Figure 12-7 and converted to pcus in Figure 12-8.

For the purpose of assessing the impact of the proposed quarry extension through the R339 / L-7109 junction the forecast flows with the proposed development in place are shown in terms of pcus in Figures 12-9 and 12-10 for the opening year 2021 and future year 2036 respectively. The traffic impacts of the proposed development are assessed in Section 12.5 of this EIAR.

It is noted that a Battery Storage facility located on a site located off the L-7109 just to the south of the Cashla Quarry Site was recently granted planning permission by Galway County Council. For the purpose of testing the potential cumulative impacts of the two developments, the additional traffic movements generated by the Battery Storage facility, and the year 2036 with the proposed quarry extension and battery storage facility in place are shown in Figures 12.11 and 12.13 respectively.

Table 12-4 Existing Coshla Quarry HGV movements, daily flow profile and movements per hour

Time	Daily flow profile of existing HGVs		Existing HGV movements	
	HGVs in	HGVs out	HGVs in	HGVs out
07:00	2%	3%	1	2
08:00	4%	3%	2	2
09:00	13%	13%	6	6
10:00	13%	9%	6	4
11:00	10%	13%	5	6
12:00	12%	11%	6	5
13:00	10%	11%	5	5
14:00	13%	13%	6	6
15:00	10%	10%	5	5
16:00	7%	8%	3	4
17:00	4%	5%	2	3
18:00	0%	0%	0	0
Total	100%	100%	47	47

Table 12-5 Coshla Quarry HGV movements, existing, extension generated and with extension

Time	Existing HGV movements		Additional extension HGV movements		With extension HGV movements	
	HGVs in	HGVs out	HGVs in	HGVs out	HGVs in	HGVs out
07:00	1	2	2	3	3	5
08:00	**2**	**2**	**4**	**3**	**6**	**5**
09:00	6	6	12	12	18	18
10:00	6	4	12	8	18	12
11:00	5	6	9	12	14	18
12:00	6	5	11	10	17	15

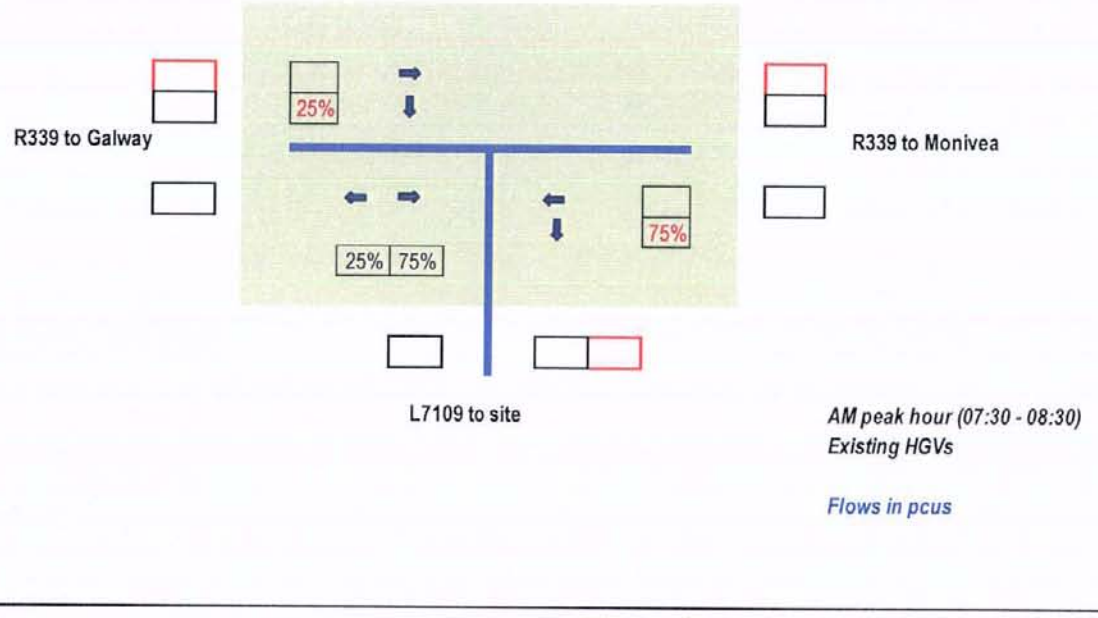
Time	Existing HGV movements		Additional extension HGV movements		With extension HGV movements	
	HGVs in	HGVs out	HGVs in	HGVs out	HGVs in	HGVs out
13:00	5	5	9	10	14	15
14:00	6	6	12	12	18	18
15:00	5	5	9	9	14	14
16:00	**3**	**4**	**6**	**7**	**9**	**11**
17:00	2	3	4	5	6	8
18:00	0	0	0	0	0	0
Total	47	47	92	92	139	139

12.1.3.6 Proposed Development Access Junction

There is an established junction currently serving the existing Coshla Quarry (see Plates 12.4 to 12.6) off the L-7109. This junction provides for existing HGV movements and it is proposed that it will provide for additional traffic generated by the proposed extension.

The existing markings at the junction are worn and it is proposed that STOP lines and markings are re-instated in accordance with Figure 7.35 of the Traffic Signs Manual, as shown in Figure 12.13.

The visibility splays available at the junction are shown in Figure 12.14. To the north the full 2.4m X 120m visibility splay (in accordance with Galway City Development Plan 2015 – 2021, Table 13.4 for an 85km/h design speed), is available. To the south the visibility splay is constrained by the bend to approximately 60m. While this is short of the development plan requirements, northbound speeds on the L-7109 are also constrained by the horizontal alignment, and it is considered that visibility in the southbound direction is sufficient to provide a safe environment for traffic exiting this junction.



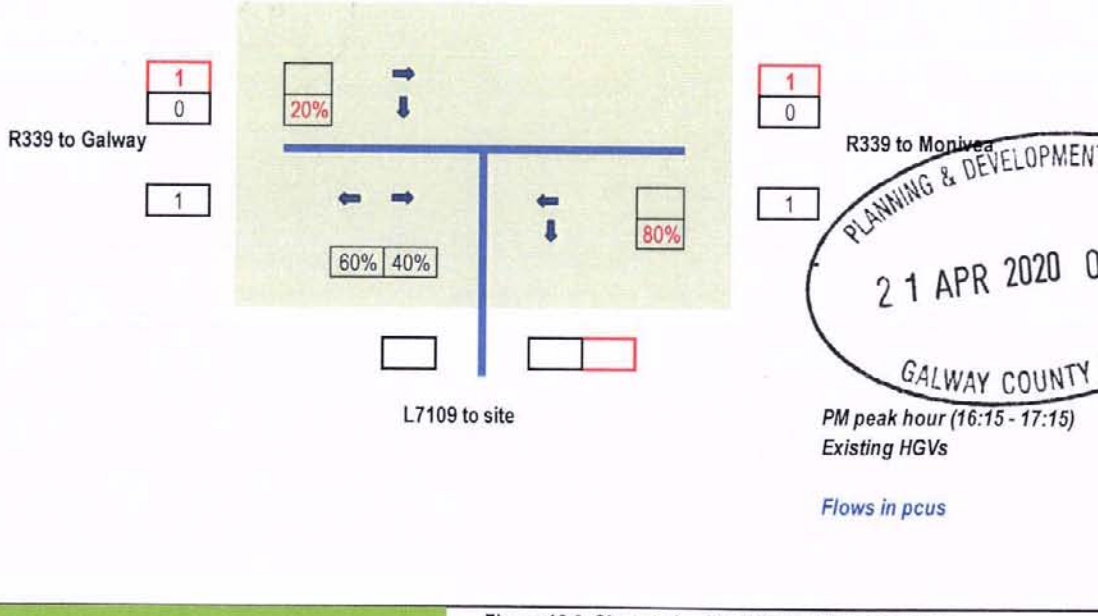


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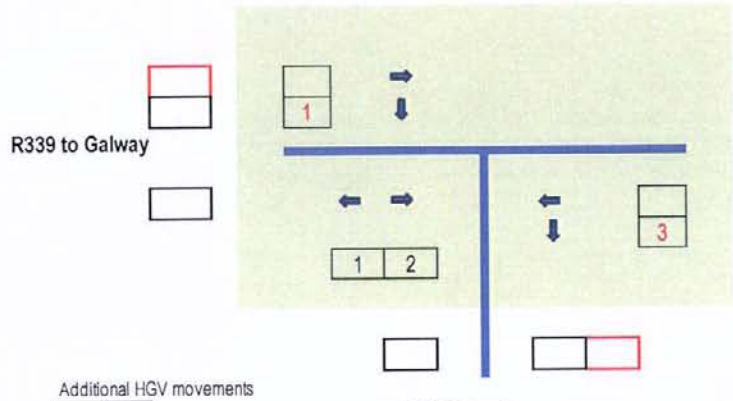
Figure 12.6 Observed split of HGV traffic movements, AM and PM peak hours

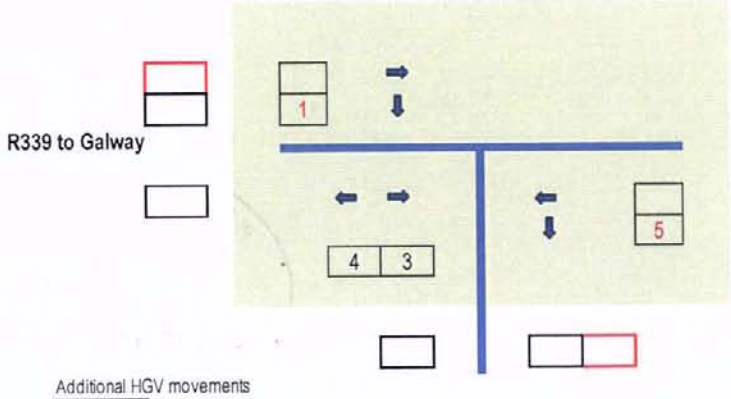


Additional HGV movements

In	Out
4	3

AM peak hour (07:30 - 08:30)
Existing HGVs

Flows in HGVs



Additional HGV movements

In	Out
6	7

PM peak hour (16:15 - 17:15)
Existing HGVs

Flows in HGVs

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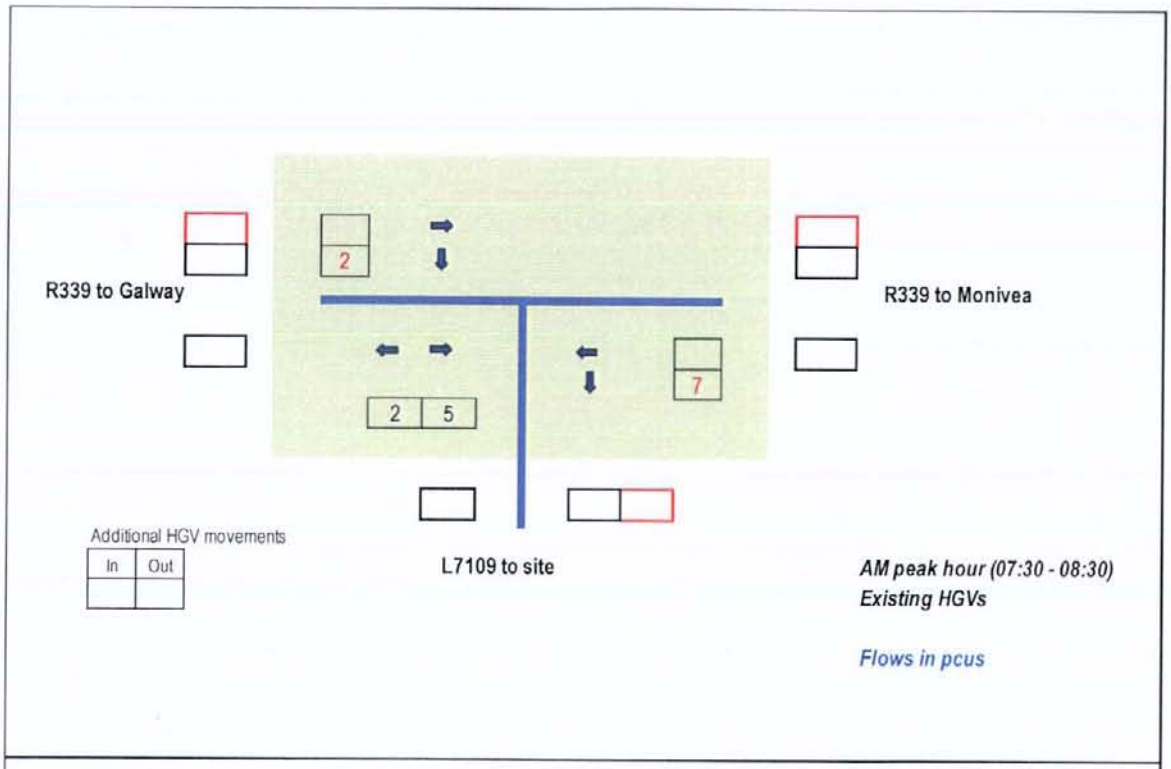
Figure 12.7 Additional development generated HGV traffic movements, AM and PM peak hours



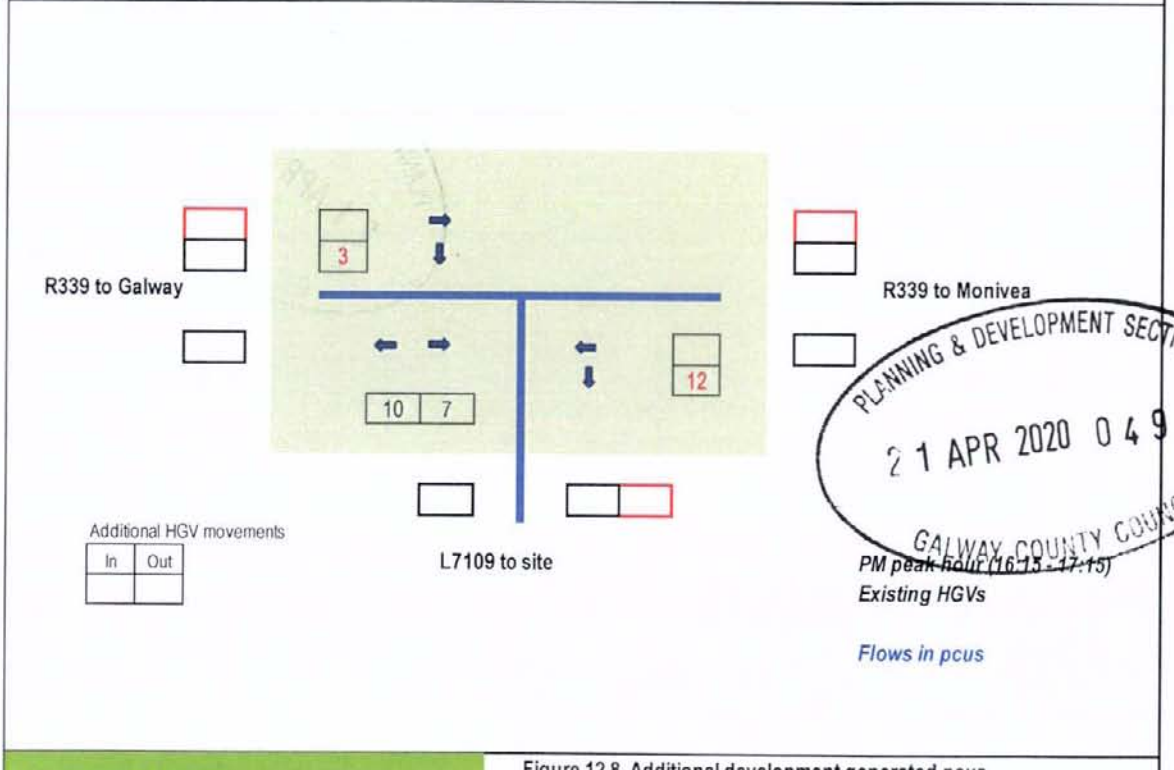


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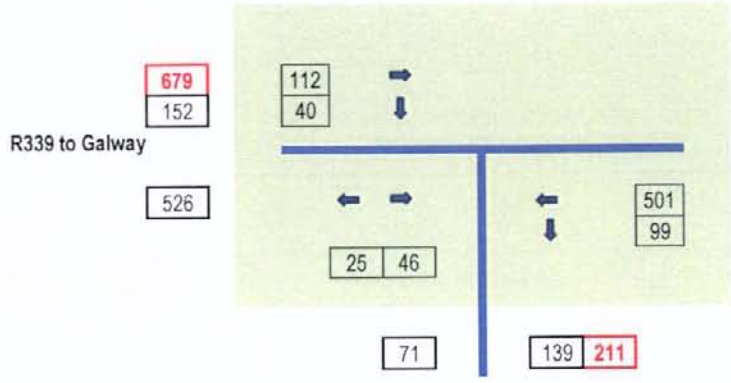
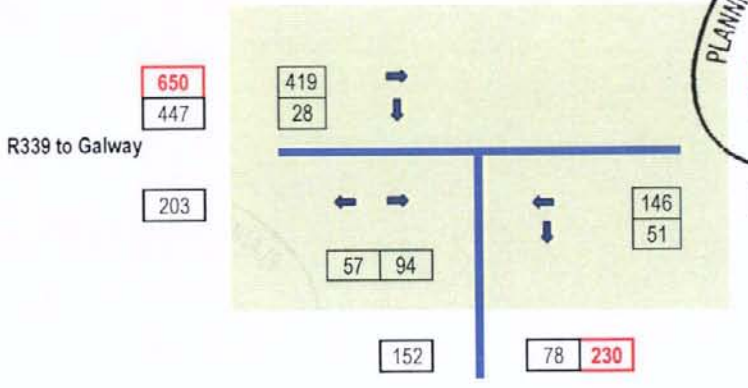
Figure 12.8 Additional development generated pcus, AM and PM peak hours



With development year 2021
AM peak hour (07:30 - 08:30)
With proposed development

Flows in pcus



With development year 2021
PM peak hour (16:15 - 17:15)
With proposed development

Flows in pcus

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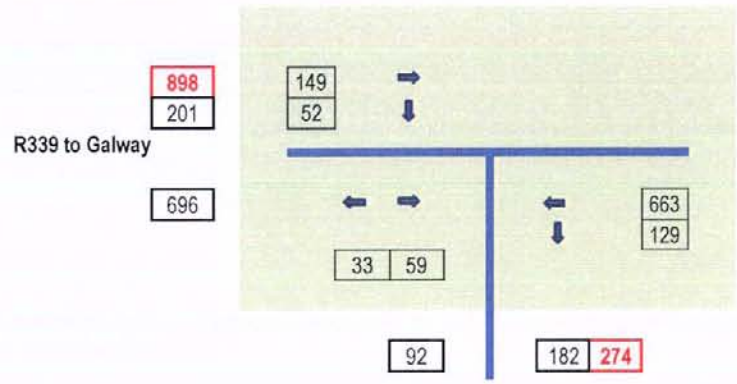
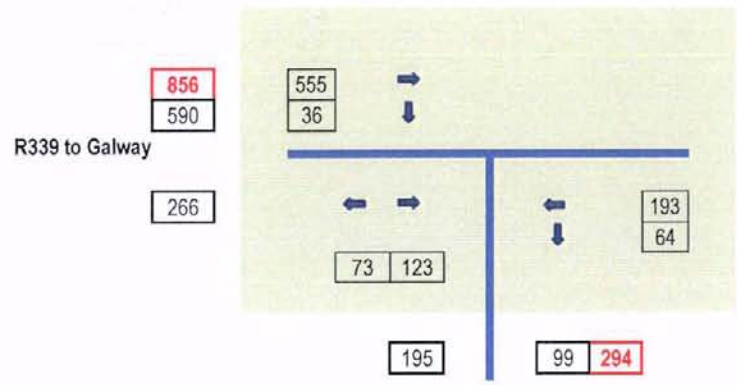
Figure 12.9 With development traffic flows, AM and PM peak hours, Opening year 2021, with development



With development year 2036
AM peak hour (07:30 - 08:30)
With proposed development

Flows in pcus



With development year 2036
PM peak hour (16:15 - 17:15)
With proposed development

Flows in pcus

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Figure 12.10 With development traffic flows, AM and PM peak hours, Future year 2036, with development

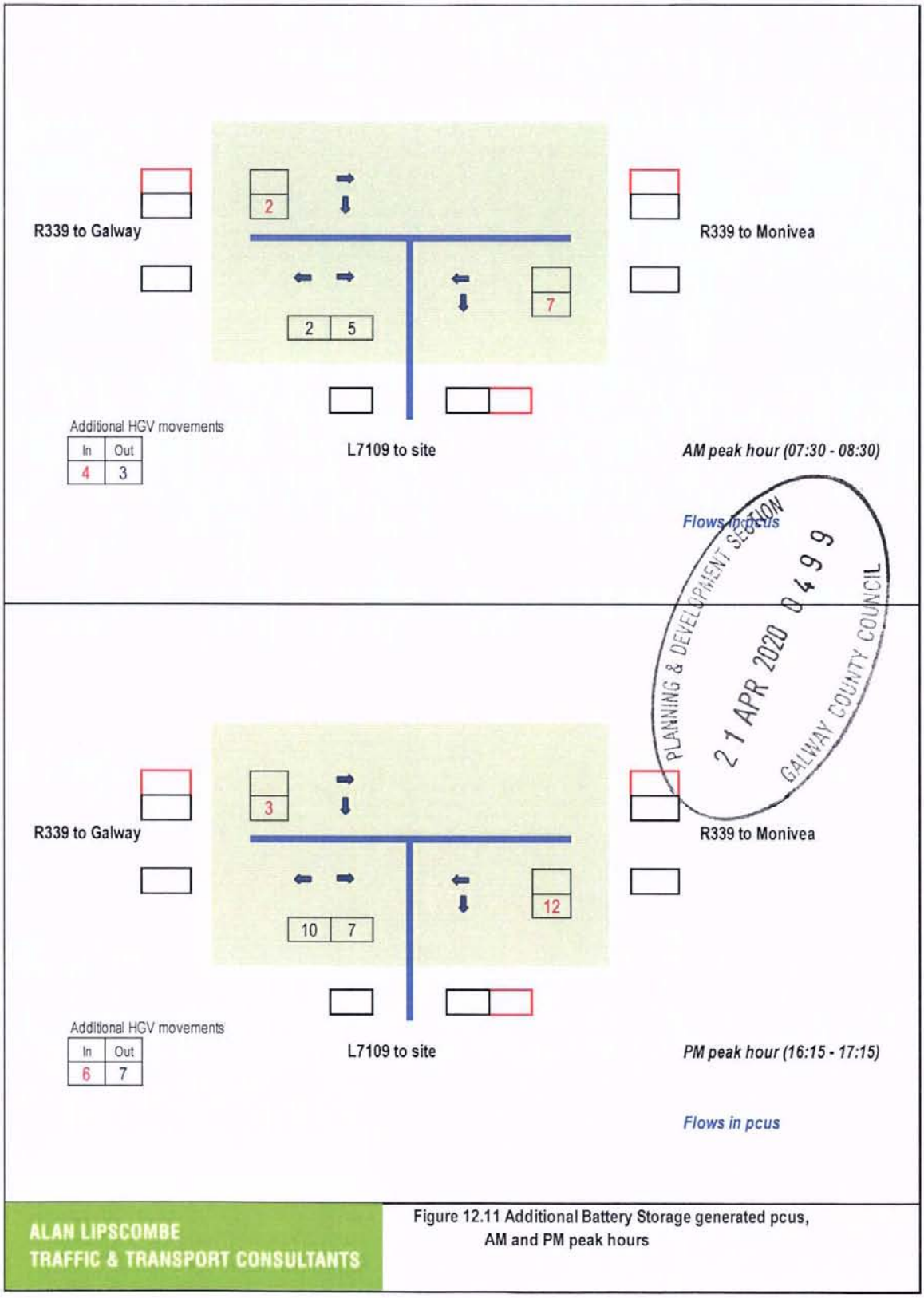

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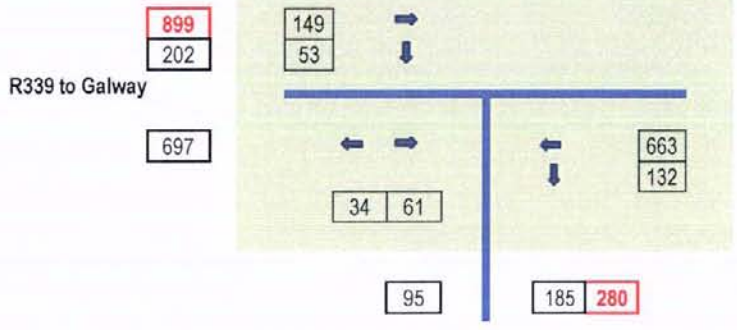
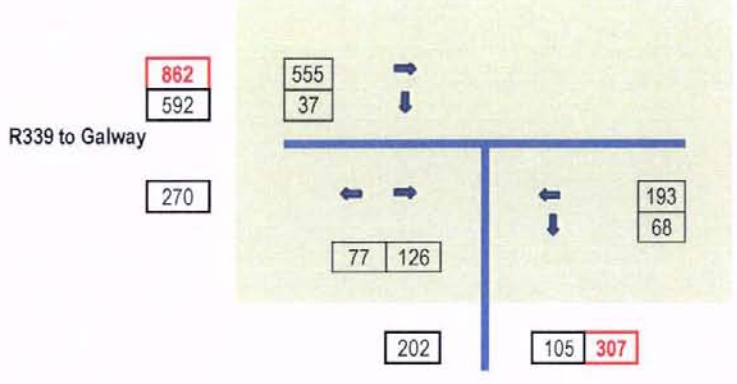
Figure 12.11 Additional Battery Storage generated pcus, AM and PM peak hours



With development year 2036
AM peak hour (07:30 - 08:30)
With proposed development
and battery storage
Flows in pcus



With development year 2036
PM peak hour (16:15 - 17:15)
With proposed development
and battery storage
Flows in pcus

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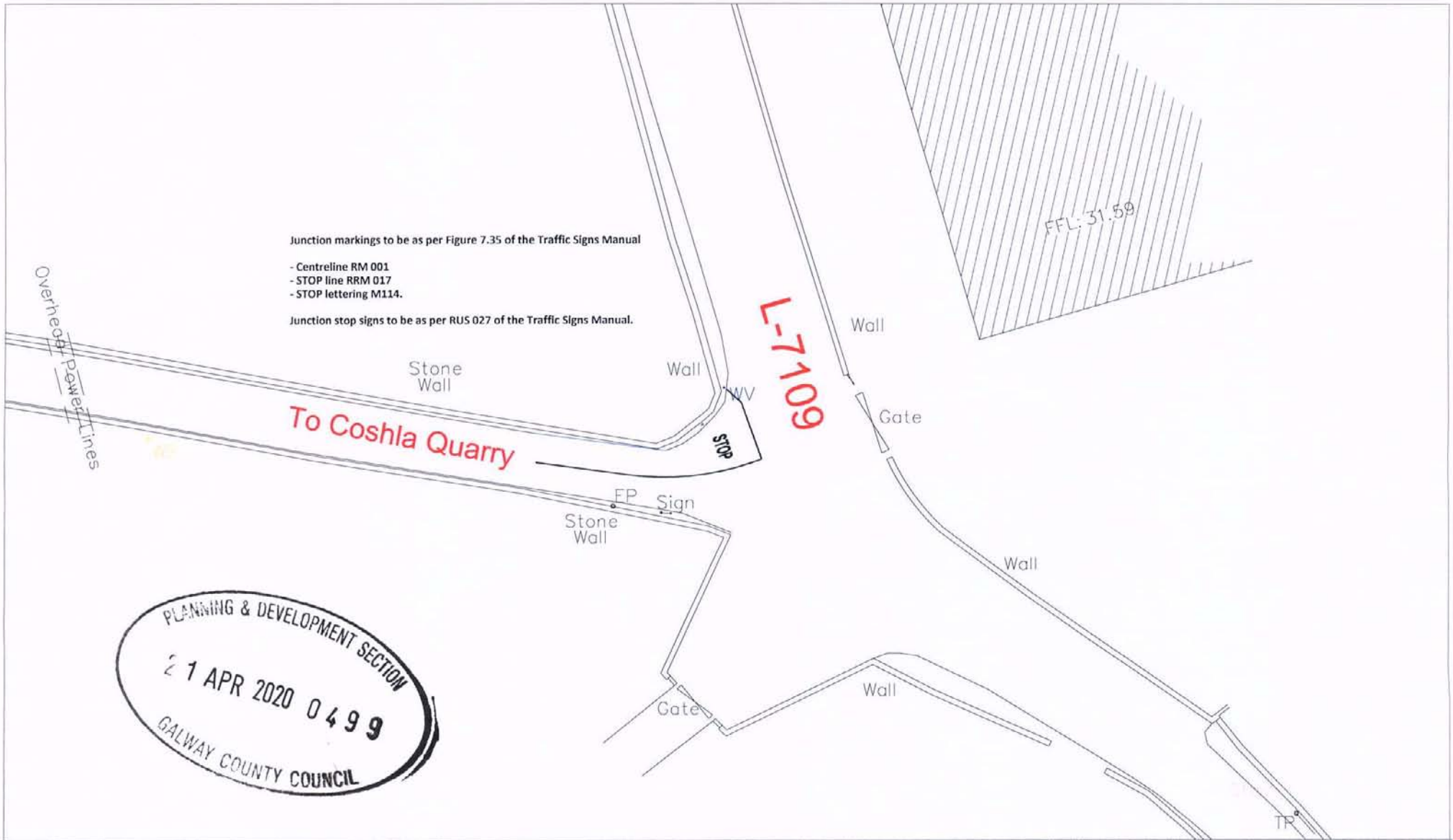
Figure 12.12 With development + Battery Storage traffic flows, AM and PM peak hours, future year 2036, with development



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 12.13 Coshla Quarry access junction on L7109 - proposed markings

PROJECT:	Coshla Quarry Extension		
CLIENT:	Coshla Quarry Ltd	SCALE:	1:500
PROJECT NO: 6260	DATE: 10.01.20	DRAWN BY:	AL

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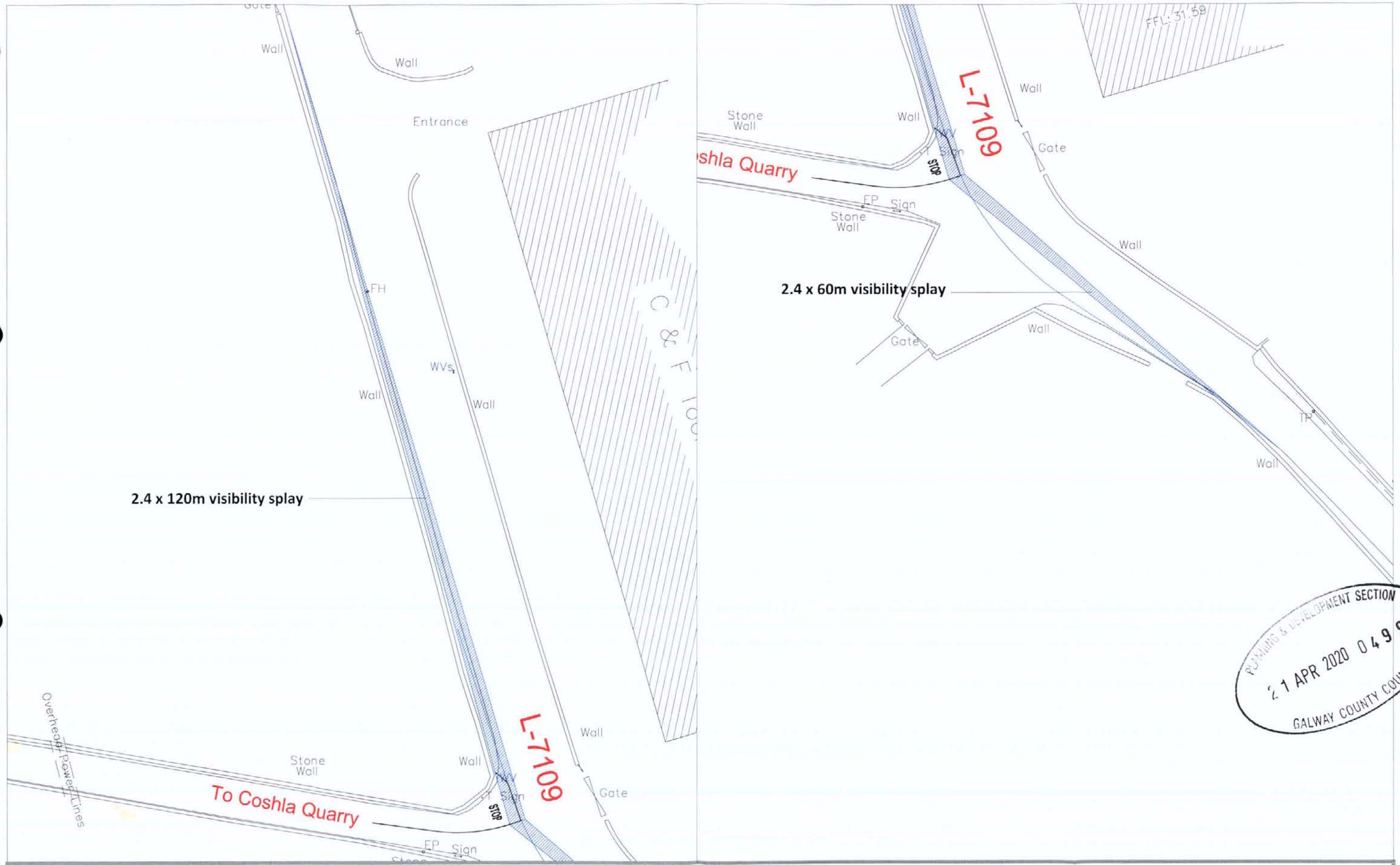

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 12.14 Coshla Quarry access junction on L7109 - available visibility splays

PROJECT:	Coshla Quarry Extension				
CLIENT:	Coshla Quaries Ltd			SCALE:	1:500
PROJECT NO: 6260		DATE:	20.01.20	DRAWN BY:	AL

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12.1.4 Traffic Effects of Coshla Quarry Extension

Opening year 2021 and future year 2036 background traffic levels on the study network, together with additional traffic generated by the proposed quarry extension are shown in Tables 12.6 and 12.7 respectively. The tables show the following,

R339

It is forecast that on the R339 Monivea Road there will be a maximum increase of 2% in pcus during the PM peak hour with an additional 18 pcus generated on the R338 (eastern arm). During a 12 – hour day the maximum increase is forecast to be 2%, or an additional 220 pcus.

L-7109 to site

On the L-7109 leading to the site it is forecast that the flow will increase by up to 12% during the PM peak hour with an additional 21 pcus forecast. During a 12-hour day it is forecast that the additional 441 pcus will result in a 15% increase.

Based on the above it is forecast that the level of increase forecast on the R339 and the L-7109 will have a slight negative effect and will be long term.

R339 / L-7109 junction

A detailed assessment of the capacity of the R339 / L-7109 junction was undertaken, with the method and findings set out in Appendix 12.4. The principal finding of the assessment is that the proposed development will have a slight impact on the operation of the junction, increasing the maximum ratio of flow to capacity (RFC) from 53.8% based on the existing level of development during the PM peak hour, to 58.9% with the introduction of the proposed quarry extension, and to 63.8% with the inclusion of the Battery Storage facility tested for the purpose of potential cumulative impact. With up to 85% considered to be acceptable, it is forecast that the R339 / L-7109 junction will operate well within capacity for all scenarios, and that the proposed quarry extension will have a slight impact on the junction capacity.

Table 12-6 Link flows for without and with proposed development, by time period, year 2021, pcus

Time period	Arm	Existing development	With proposed development	Increase	% difference
AM peak hour	R338 (east)	988	1,000	12	1%
	L-7109 (to quarry)	257	274	17	7%
	R338 (west)	894	898	4	0%
PM peak hour	R338 (east)	916	934	18	2%
	L-7109 (to quarry)	263	294	31	12%
	R338 (west)	843	857	14	2%
All day	R338 (east)	11,619	11,839	220	2%

Time period	Arm	Existing development	With proposed development	Increase	% difference
	L-7109 (to quarry)	3,022	3,463	441	15%
	R338 (west)	10,513	10,733	220	2%

Table 12-7 Link flows for without and with proposed development, by time period, year 2036, pcus

Time period	Arm	Existing development	With proposed development	Increase	% difference
AM peak hour	R338 (east)	746	758	12	2%
	L-7109 (to quarry)	194	211	17	9%
	R338 (west)	675	679	4	1%
PM peak hour	R338 (east)	692	710	18	3%
	L-7109 (to quarry)	199	230	31	16%
	R338 (west)	637	650	13	2%
All day	R338 (east)	8,773	8,993	220	3%
	L-7109 (to quarry)	2,281	2,722	441	19%
	R338 (west)	7,938	8,158	220	3%

12.1.5 Provision for Sustainable Modes of Travel

12.1.5.1 Walking and Cycling

The provision for these modes in not relevant for the subject development.

12.1.5.2 Public Transport

This mode is not relevant to the subject development.

12.1.6 Likely and Significant Impacts and Associated Mitigation Measures

12.1.6.1 'Do-Nothing' Scenario

If the proposed quarry extension does not proceed, the current permission would expire, after which, the site would be restored. This would result in a reduction in traffic volumes on the road network. The existing road network operates safely and within capacity and so the reduction in traffic would be 'neutral'.

12.1.6.2 Proposed Coshla Quarry Extension

If the proposed Quarry Extension is implemented it is forecast that the increase in traffic levels on the R339 and the L-7109 leading towards the site will have a slight negative effect and will be long term.

12.1.6.3 Residual Impacts

There will be a slight negative traffic related residual impact to existing road users as a result of the proposed quarry extension.

12.1.6.4 Cumulative Effects

In the event that the proposed Coshla Quarry Extension is in operation at the same time as the recently granted Battery Storage facility is constructed, it is forecast that the cumulative impact on the R339 and L-7109 will be slight and will be temporary.

The proposed Apple Data Centre in Athenry also has the potential to have cumulative traffic impacts with the subject development is the Apple Data Centre in Athenry. Although it is understood that this project is not proceeding, since planning permission has been granted there is the potential that the applicant or another entity could progress the project at some point in the future. Should the construction of the Data Centre take place when the Coshla Quarry is in operation, as the two developments will generate traffic on different parts of the road network (ie Apple Data Centre on the M6 and the Coshla Quarry on the R336 Monivea Road) it is considered that the potential for cumulative traffic related impacts will be imperceptible.

Planning permission was recently granted for an infill facility at Barrettspark (Planning Reference No 19/325) located just to the south of the subject development. While traffic generated by both developments will share the same delivery routes, as the traffic volumes generated by the granted infill facility will be low, it is considered that the potential for cumulative traffic related impacts will be slight.

12.1.7 Summary/Conclusion

The extension proposed for the existing Coshla Quarry located in the townland of Barrettspark, Athenry, County Galway, will be implemented together with minor improvements to the existing development access junction on the L-7109.

It is demonstrated that the modest increase in traffic that will be generated by the proposed extension will have slight negative impacts on general traffic on the R339 and the L-7109 and on existing traffic movements generated by the Coshla Quarry. It is also established that the additional traffic movements will be adequately accommodated by the existing R339 / L-7109 junction.

12.2 Electricity and Other Services

12.2.1 Statement of Authority

This section of the EIAR has been prepared by Thomas Blackwell and reviewed by Michael Watson, both in MKO. Thomas Blackwell is a Senior Environmentalist and Michael Watson is a Project Director with MKO; with over 15 and 18 years of experience in the environmental sector respectively. Their environmental experiences involves report writing of Environmental Reports (ER), Environmental Impact Statements/Environmental Impact Assessment Reports (EIS/EIAR) & Strategic Environmental Assessments (SEA) as well as project management of a variety of small and large scale jobs, including residential and commercial development projects.

12.2.2 Consultation

The relevant national and regional authorities and bodies listed in Section 2.4 were consulted to identify any potential impact on material assets. Acknowledgements were received from ESB Networks, the HSE, and Transport Infrastructure Ireland. The scoping responses are discussed in further detail in Section 2.4.2 of this EIAR.

12.2.3 Operational Methodology

The operational methodology detailed in Chapter 3 of this EIAR describes the manner in which quarry extension will occur. Prior to works, the area where excavations are planned will be surveyed and all existing services will be identified. All relevant bodies i.e. ESB, Bord Gáis, Eir, Galway County Council etc. will be contacted and all drawings for all existing services sought.

12.2.4 Receiving Environment

The proposed development could have the potential to impact the following infrastructure:

- Electricity Network
- Telecommunication Networks

12.2.4.1 Electricity Network

There are two 100kV overhead electricity cables crossing the proposed site. No underground electrical services exist within the proposed quarry expansion area. Relocation of the overhead electrical services that cross the site will not be required. The quarry operator is in communication with ESB Networks regarding work in the vicinity of overhead lines.

12.2.4.2 Telecommunications Networks

There are no telecommunication networks within the proposed expansion area of the quarry.

12.2.5 Likely and Significant Impacts and Associated Mitigation Measures

12.2.5.1 Do-Nothing Impact

The site currently comprises an active quarry site. Should the proposed development not proceed the quarry would continue to operate until the expiration of its current planning permission in March 2021. The potential impacts are considered imperceptible.

12.2.5.2 Operational Phase

The operation of the proposed development will have an imperceptible impact on above ground or underground electrical or telecommunications networks. There are no known telecommunication services in the proposed quarry expansion area.

Mitigation Measures

Appropriate safety measures are in place for working in the vicinity of existing overhead electrical lines.

Residual Impacts

There will be an overall imperceptible, neutral impact on electricity and telecommunications networks.

Significance of Effects

Based on the assessment above there will be no significant effects.

12.2.5.3 Decommissioning Phase

The reclamation of the quarry site following cessation of rock extraction will be accomplished using materials already located on the site. There is no potential for impacts on non-traffic material assets.

12.2.5.4 Cumulative Effects

The potential cumulative impacts and associated effects between the proposed development and the projects described in Section 2.5.2 of this EIAR, hereafter referred to as the other projects, have been considered in terms of telecoms and other services.

Due to the likely imperceptible, neutral effects of the proposed project on electrical and telecommunication networks, any potential for cumulative effects between the proposed development and the other projects during the operational phase of the project is negligible.

There will be no cumulative decommissioning phase effects in relation to telecommunications and other services.

13. INTERACTION OF EFFECTS

13.1 Introduction

The preceding Chapters 4 to 12 of this EIAR identify the potential environmental impacts that may have occur as a result of the proposed development in terms of Human Beings, Population and Human Health, Biodiversity, Flora and Fauna, Land, Geology and Soils, Hydrology and Hydrogeology, Air and Climate, Noise and Vibration, Landscape and Visual, Archaeological and Cultural Heritage and Traffic and Transportation. All of the potential significant effects of the proposed development and the measures proposed to mitigate them have been outlined in the preceding sections of this report. However, for any development with the potential for significant environmental effects there is also the potential for interaction amongst these potential significant effects. The result of interactive effects may exacerbate the magnitude of the effects or ameliorate them, or have a neutral effect.

A matrix is presented in Table 13.1 below to identify interactions between the various aspects of the environment already discussed in this EIAR above. The matrix highlights the occurrence of potential positive or negative effects of the proposed development. The matrix is symmetric, with each environmental component addressed in the previous sections of this EIAR being placed on both axes of a matrix, and therefore, each potential interaction is identified twice.

Table 13.1 Interaction Matrix: Potential for Interacting Impacts

	Population & Human Health	Biodiversity, Flora & Fauna	Land, Soils & Geology	Water	Air & Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage	Material Assets
Population & Human Health									
Biodiversity, Flora &Fauna									
Land, Soils & Geology									
Water									
Air & Climate									
Noise & Vibration									
Landscape & Visual									
Cultural Heritage									
Material Assets									

Legend: **No Interacting Effect:** **Positive Effect:** **Neutral Effect:** **Negative Effect:**

The potential for interaction of effects has been assessed as part of the Impact Assessment process. While the work on all parts of the EIAR were not carried out by MKO, the entire project and all the work of all sub-consultants was managed and coordinated by the company. This EIAR was edited and collated by MKO as an integrated report of findings from the impact assessment process, by all relevant experts, and effects that potentially interact have been assessed in the individual chapters of the EIAR above.

13.2 Impact Interactions

Where any potential significant negative effects have been identified during the assessment process, these impacts have been avoided by design or reduced by the proposed mitigation measures.

13.2.1 Population and Human Health

Population & Human Health and Land, Soils & Geology

The extraction of the bedrock resource in the course of the quarrying activity generates employment opportunities and a marketable product of no distinguishable value until it is extracted in the quarry, which in turn generates activity in the local economy from the sale of the local resource.

Population & Human Health and Water

The proposed extension of the quarry has the potential to give rise to some water pollution as a result of site activities, and any water pollution could impact on other users of that water within the catchment. Mitigation measures are presented in Chapter 7 to minimise the risk of any such issues.

Population & Human Health and Air & Climate

The proposed extension of the quarry has the potential to create dust and other less noticeable air pollutants, which could give rise to nuisance for occupants of nearby dwellings. Mitigation measures are presented in Chapter 8 to minimise the risk of any such issues.

Population & Human Health and Noise & Vibration

The proposed extension of the quarry has the potential to create noise and some vibration, which could give rise to nuisance for occupants of nearby dwellings. Mitigation measures are presented in Chapter 9 to minimise the risk of any such issues.

Population & Human Health and Landscape

The restricted visibility of the site ensures that the development will not significantly change the character of the local landscape. The growth of hedges, building of berms around the site and the planting of trees along the boundary of the site means that the change in landscape character will not be particularly apparent from the outside.

Population & Human Health and Material Assets

The impact of the additional traffic generated by the proposed extension will be slight on the R339 and the L-7109 and imperceptible on the wider network. The proposed quarry extension is not likely to cause any increased inconvenience for road users.

13.2.2 Biodiversity, Flora and Fauna

Biodiversity, Flora & Fauna and Hydrology & Hydrogeology

Site activities have the potential to give rise to some water pollution, and consequential impacts on flora and fauna that rely on or use that water within the same catchment. These potential impacts have been assessed, and the relevant measures will be in place to avoid any water pollution and subsequent effect on flora and fauna.

Biodiversity, Flora & Fauna and Noise & Vibration

Site activity during the operation of the quarry has the potential to give rise to noise and some vibration that could disturb fauna.

13.2.3 Hydrology and Hydrogeology

Water Quality and Land, Soils & Geology

The movement and removal of soils, overburden and rock as part of the quarrying process has the potential to give rise to negative impacts on water quality in the absence of appropriate mitigation. Mitigation measures are presented in Chapter 6.

13.2.4 Air and Climate / Noise

Air & Climate and Land, Soils & Geology

The movement and removal of soils, overburden and rock as part of the quarrying process has the potential to give rise to dust impacts in the absence of appropriate mitigation. Mitigation measures are presented in Chapter 8.

Air & Climate and Traffic & Transport

The movement of vehicles both within and to and from the site has the potential to give rise to noise and dust nuisance effects during the quarry operation phase which has the potential to negatively effect local air quality. This is assessed further in Chapter 8 of this EIAR, and mitigation measures are presented to minimise any potential effects.

13.3 Mitigation and Residual Impacts

Where any potential interactive negative impacts have been identified in the above, a full suite of appropriate mitigation measures has already been included in the relevant sections (Chapters 4-12) of the EIAR. The implementation of these mitigation measures will reduce or remove the potential for these effects. Information on potential residual effects, and their significance, is also presented in each relevant chapter.

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APPENDIX 2-1

SCOPING RESPONSES

Roinn Cumarsáide, Gníomhaithe ar son na hAeráide & Comhshaoil
Department of Communications, Climate Action & Environment

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

MKO
Tuam Road
H91 VW84
County Galway

27 November 2019

Re: Informal EIAR Scoping for Coshla Quarry extension, Cashla, Athenry, Co. Galway

Your Ref: 180918
Our Ref: 19/259

Thomas, a chara,

With reference to your email received on 14 November 2019, concerning the proposed extension of Coshla Quarry in the townland of Barrettspark, Co. Galway, Geological Survey Ireland (a division of Department of Communications, Climate Action and Environment) would like to make the following comments:

Geological Survey Ireland is the national earth science agency and has datasets on Bedrock Geology, Quaternary Geology, Geological Heritage Sites, Mineral deposits, Groundwater Resources and the Irish Seabed. These comprise maps, reports and extensive databases that include mineral occurrences, bedrock/mineral exploration groundwater/site investigation boreholes, karst features, wells and springs. Please see our website for data availability and we recommend using these various data sets, when undergoing the planning and scoping processes. Geological Survey Ireland should be referenced to as such and should any data or geological maps be used, they should be attributed correctly to Geological Survey Ireland.

Geoheritage

Geological Survey Ireland (GSI) is in partnership with the National Parks and Wildlife Service (NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs) to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Irish Geoheritage Programme (IGH) of GSI, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGS), as adopted under the National Heritage Plan are now included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer. Though the audit for Co. Galway will be published later this year, **our records show that there are no current CGSs in the vicinity of Coshla Quarry.**

Our aim is not to prevent further quarrying, as the very process of extraction provides Geological Survey Ireland with much valuable data that can be added to our national databases, but our purpose in protecting and promoting geological heritage is partly educational both for the public and the geologist. The IGH programme has numerous working quarries on its database where there are significant geological sections or features exposed within the quarry. In fact, new exposures through quarrying may reveal new features of interest to the geologist, and we have in the past requested that periodic monitoring of the new faces be permitted. In this respect, Geological Survey Ireland would appreciate notification of commencement from the applicant.

We also encourage discussion on end-of-life plans for the quarry and would be happy to recommend ways to promote the geology to the public or develop tourism or educational resources if appropriate. Geological Survey Ireland would like to offer help with interpretative signs where interesting geological features have been exposed, if appropriate.

The Geoheritage Programme tries to promote a partnership between geological heritage and active quarrying, with such measures as those outlined in the 'Geological Heritage Guidelines for the Extractive Industry', which can be downloaded here. This document, written in association with Irish Concrete Federation, acts as a

comprehensive guide in the sustainable extraction of natural resources while preserving the geological heritage of Ireland.

Groundwater

Groundwater is important as a source of drinking water, and it supports river flows, lake levels and ecosystems. It contains natural substances dissolved from the soils and rocks that it flows through, and can also be contaminated by human actions on the land surface. As a clean, but vulnerable, resource, groundwater needs to be understood, managed and protected. Through our Groundwater Programme, Geological Survey Ireland provides advice and maps to members of the public, consultancies and public bodies about groundwater quality, quantity and distribution. Geological Survey Ireland monitors groundwater nationwide by characterising aquifers, investigating karst landscapes and landforms and by helping to protect public and group scheme water supplies. With regard to Flood Risk Management, there is a need to identify areas for integrated constructed wetlands. We recommend using the GSI's National Aquifer and Recharge maps on our Map viewer to this end.

Geological Survey Ireland commends the use of our subsoils, aquifer and groundwater vulnerability datasets in the 'Description of the development site' section of the informal EIAR scoping, and hope to see these datasets also included in the final EIAR.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me, or my colleague Clare Glanville (Clare.Glanville@dccae.ie).

Le meas,

Amrine Dubas Gafar

Amrine Dubois Gafar
Geoheritage Programme

PLANNING & DEVELOPMENT SECTION
21 APR 2020 0499
GALWAY COUNTY COUNCIL

Thomas Blackwell

From: MKO-Admin
Sent: Wednesday 20 November 2019 12:47
To: Thomas Blackwell
Subject: FW: CO GALWAY CONSULTATION EIAR scoping Coshla Quarry extension

From: Ian Lumley <heritage@antaisce.org>
Sent: 20 November 2019 12:39
To: MKO-Admin <info@mkoireland.ie>
Subject: Fwd: CO GALWAY CONSULTATION EIAR scoping Coshla Quarry extension

To Thomas Blackwell

RE GALWAY CONSULTATION EIAR scoping Coshla Quarry extension : Response to LETTER OF 14 Nov WITH ENCLOSURE

Compliance with conditions attached to An Bord Pleanala consent PL 07.235831 in 2010 should be demonstrated as preliminary matter

Ian Lumley

--
An Taisce - The National Trust for Ireland | www.antaisce.org
The Tailors' Hall, Back Lane, Dublin 8, Ireland
Company Reg. No. 12469 | Charity Ref. No. CHY4741 | Charity Regulator No. 20006358
An Taisce is a membership-based charity
Join at www.antaisce.org/membership

Thomas Blackwell

From: info@birdwatchireland.ie
Sent: Thursday 14 November 2019 14:51
To: Thomas Blackwell
Subject: RE: FAO: Policy and Advocacy Team - 180918 - Coshla Quarry Expansion EIAR Scoping

Hi Thomas,
We would like to acknowledge receipt of your email confirm that this has been forwarded to our Policy officer .

Regards,
Michelle Kavanagh,
Membership Department.
BirdWatch Ireland
Unit 20 Block D | Bullford Business Campus | Kilcoole | Greystones | A63 RW83 | Co.Wicklow | Ireland
Tel: +353 (0)1 281 9878 email: mkavanagh@birdwatchireland.ie
Website: www.birdwatchireland.ie

BirdWatch Ireland - protecting wild birds and their habitats

BirdWatch Ireland - protecting birds and biodiversity

Cairde Éanlaith Éireann - ag caomhnú éin agus bithéagsúlacht

To join as a member, make a donation, volunteer or shop online visit www.birdwatchireland.ie or call us on +353 (0)1 281 9878

From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: Thursday 14 November 2019 14:42
To: info@birdwatchireland.ie
Subject: FAO: Policy and Advocacy Team - 180918 - Coshla Quarry Expansion EIAR Scoping

Dear Sir or Madam,

I write in on behalf of Coshla Quarries Ltd., who intend to apply to Galway County Council for permission to extend their existing limestone quarry at Cashla, Athenry, Co. Galway. The site is located at Cashla, which is approximately 9 kilometres to the west of Athenry and 6 kilometres to the northeast of Oranmore, Co. Galway. MKO been appointed as Environmental Consultants on this project and commissioned to prepare an Environmental Impact Assessment Report (EIAR) for the project

The attached Scoping Document provides details regarding the proposed development and the subject site, and sets out the proposed scope of work for the EIAR. Consultees are invited to contribute to the EIAR informing the planning process by suggesting baseline data, survey techniques and potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. We would welcome any comments you have at this stage of the process.

If you require any further information, please do not hesitate to contact me.

Yours sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

Thomas Blackwell

From: esbnetworks@esb.ie
Sent: Thursday 14 November 2019 14:40
To: Thomas Blackwell
Subject: Re: 180918 - Coshla Quarry Expansion EIAR Scoping [EX376295]

Bhain do rphost ESB Networks amach. Cuirfear freagra chugat a luaithe agus is féidir.

Chun éigeandáil a thuairisc nó eolas a thabhairt faoi idirbhrisí soláthair, glaoigh le do thoil ar 1850 372 999 nó +35321 238 2410 láithreach.
Go Raibh Maith Agat.

Your email has reached ESB Networks. We will reply as soon as possible.

To report a dangerous situation or for information on supply interruptions please call 1850 372 999 or +353 21 238 2410 immediately.
Thank You.

ESB Networks Customer Care | T: 1850372757 | +353 21 2386555 | F: +353 21 4844261 | www.esbnetworks.ie

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Dear Sir or Madam,

I write in on behalf of Coshla Quarries Ltd., who intend to apply to Galway County Council for permission to extend their existing limestone quarry at Cashla, Athenry, Co. Galway. The site is located at Cashla, which is approximately 9 kilometres to the west of Athenry and 6 kilometres to the northeast of Oranmore, Co. Galway. MKO been appointed as Environmental Consultants on this project and commissioned to prepare an Environmental Impact Assessment Report (EIAR) for the project

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If you require any further information, please do not hesitate to contact me.

Yours sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

An timpeallacht? - Smaoinigh air sula bpriontáileann tú an r-phost seo.
Please consider the Environment before printing this email.

An tSeirbhís Sláinte Comhshaoil,
Páirc Ghnó na Gaillimhe, An Daingean, Gaillimh. H91 EW40
T: (091) 737350 R: PEHO.galway@hse.ie

Environmental Health Service,
Galway Business Park, Dangan, Galway H91 EW40
Tel: (091) 737350 Email: PEHO.galway@hse.ie

Date: 12th December 2019

Name: Mr Thomas Blackwell
McCarthy Neville O'Sullivan Ltd.,
Tuam Road,
Galway
H91 VW84

Consultant's Reference: 180918

Re: Scoping Report

Proposed Development: Proposed extension to Coshla Quarry at Cashla, Athenry, Co. Galway

Applicant: Coshla Quarries Ltd.

EHIS Reference: 1043

Dear Mr. Blackwell

Please find enclosed the HSE Consultation Report in relation to the above proposal.
The following HSE departments were made aware of the consultation request for the proposed development on 18 November 2019:

- Emergency Planning – David O'Sullivan
- Estates – Helen Maher
- Assistant National Director for Health Protection – Kevin Kelleher/Laura Murphy
- CHO – Ger Reaney

If you have any queries regarding this report the initial point of contact is Mr Paul Hickey, Acting Principal Environmental Health Officer who will refer your query to the appropriate person.

Yours sincerely

Paul Hickey
Acting Principal Environmental Health Officer

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Seirbhís Sláinte Timpeallachta,
Feidhmeannacht Na Seirbhíse Sláinte,
Páirc Ghnó Na Gaillimhe,
An Daingean,
Gaillimh
H91 EW40

Environmental Health Service,
Health Service Executive,
Galway Business Park,
Dangan,
Galway
H91 EW40

☎ (091) 737357
Seamus.mitchell@hse.ie

Mr Thomas Blackwell
McCarthy Neville O'Sullivan Ltd.,
Tuam Road,
Galway
H91 VW84

HSE EIAR Scoping Consultation Report
Environmental Health Service Submission Report

Date:	12 December 2019
Our reference:	EHIS 1043
Consultant Reference:	180918
Report to:	McCarthy Neville O'Sullivan Ltd, Tuam Road, Galway
Type of Consultation:	EIA Scoping
Applicant:	Coshla Quarries Ltd.
Proposed development:	Proposed extension to Coshla Quarry at Cashla, Athenry, Co. Galway
Nature of Activity:	The proposed extension of the existing Coshla Quarry by approximately 8.4 hectares which will be contained within the existing quarry site boundary and for the continued operation of limestone quarrying activities at the existing Coshla Quarries Ltd. site at Cashla, Barrettspark, Co. Galway.

The EIAR should identify the nearest sensitive receptors and consider the impact of the existing and proposed development on them. Sensitive receptors include, but are not limited to

- occupied houses
- farms (including stud farms and facilities for the production of vegetables and crops)
- schools
- childcare facilities
- medical facilities and nursing homes
- golf courses, sports and community facilities and
- food premises.

General

The Environmental Health Service (EHS) considers the following should be assessed in the Environmental Impact Assessment (EIA)

- Any potentially significant emissions to surface water
- Any potentially significant emissions to ground water
- Any potentially significant emissions to air, including noise, vibration and dust

Other areas for consideration in the EIA include

- Staff welfare facilities
- Public consultation
- Potential for future health gain from the restoration of the proposed development
- Cumulative impacts of developments in the locality

In considering the measures to be employed by the developer to minimise the potential impacts of the proposed development to human health, reference was made by the EHS to the EPA's 'Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006'

It is recommended that an Environmental Management System (EMS) is put in place, with training of all site staff. There should be on-going review of the effectiveness of the EMS. The EMS should be devised in accordance with international standards such as ISO 14001 2015 and EU EMAS (1993).

When assessing the above potential impacts, the existing environment, the assessment methodology and evaluation criteria should be clearly reported in the EIAR. Existing baseline assessments (noise, dust, ground and surface water quality) should be included. Any mitigation proposed should be identified and the predicted residual impact clearly stated. Assessment should be carried out for both the operation phase and the remedial phase of the proposed development.

Emissions to surface water

Should any proposed activities result in potential discharges to surface water, these activities must comply with the provisions of the Local Government (Water Pollution) Acts 1977 and 1990 and the Water Services Acts 2007-2013. If a discharge licence is required, it is recommended that the developer undertake a surface water quality baseline study to assess the existing water quality and its assimilative capacity.

Where it is proposed that there will be discharges of treated effluent from the limestone quarry into nearby watercourses, the following Emission Limit Values (ELVs) are recommended

- pH less than 9
- BOD 25mg/l
- Total Suspended Solids 35mg/l
- NO_3 50mg/l
- Chemical Oxygen Demand 100mg/l O_2

The EIA should include details as to how these ELVs will be achieved.

A suitable drainage system should be provided which minimises surface water run-off into limestone quarry extraction pit workings. This system can be by means of open channels that drain to a central storage settlement lagoon with narrow bore discharge pipes to limit flow. Lagoons should be of sufficient size to cope with flooding and periods of heavy rain and should be adequately sealed with an impermeable material to prevent leaching to groundwater.

Hard standing areas used for refuelling vehicles should drain to hydro carbon interceptors prior to discharge.

Details of the fuels and chemicals used and stored on site and the method proposed for the bunding of fuel and chemical storage tanks should be provided in the EIA. Provision should be made for the inspection and monitoring of bunding structures.

In order to minimise the wastage of water, surface water should be used for activities such as wheel washing and dust suppression.

Emissions to Groundwater

It is recommended that detailed information is gathered on the location of private wells serving properties within a 2km radius of the proposed facility. The EIA should include proposals for sampling private wells (if planning permission is granted) prior to works commencing to the quarry extension; at least biannually during the operation of the quarry and twice within the first year following cessation of operations at the site. These wells should be assessed against the parameters specified in the Drinking Water Regulations (S.I No. 122 of 2014).
Reference should be made in the EIA to the Geological Survey of Ireland's (GSI) Groundwater Protection Scheme for Co. Galway to determine if there are vulnerable groundwater sources or aquifers in the vicinity of the proposed development.

Emissions to air, including noise, vibration and dust

The EHS recommends that the developer notes the limit values specified in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) which apply to ambient air quality in the vicinity of developments such as limestone quarries.
The EIA should establish baseline air quality at the nearest sensitive receptors by means of background air quality monitoring. Air quality monitoring should be undertaken prior to the commencement of operations in the quarry extension and throughout the operation of the site using the Bergerhoff Method as specified in the German TA Luft Air Quality Standards (TA Luft 1986). Total dust deposition should not exceed 350mg/m2 /day when averaged over a thirty day period. This is a maximum limit and the EMS should be such that dust depositions seldom reach this level.

The Environmental Management System should include dust minimisation and suppressions measures to be employed to minimise the impact of dust emissions from the quarry. Methods can include, but are not limited to

- Wheel washing of every vehicle leaving the site
- Covering every load on vehicles leaving the site
- Protect and replace vegetation on site
- Where possible, use enclosed conveyors rather than trucks within the site
- Cover stockpiles to prevent windblown dust
- Spray and wash access and haul roads frequently to suppress dust
- Provide screening berms of adequate height

- Undertake regular plant and vehicle maintenance
- Undertake regular monitoring and inspection of access and haul roads to identify and attend to accidental spillages and structural defects to roads (i.e. potholes). Proposals for an agreement between the local roads authority and the applicant for the on-going maintenance of haul roads during the operation of the proposed development should be outlined.
- Considering meteorological conditions (wind speed and wind direction) when siting stockpiles

If it is proposed to undertake blasting on site, the EHS recommends that a Vibration Monitoring Report is included in the EIA which includes blasting methods to be employed during the operation of the proposed quarry. An advanced notification system, advising occupants in the locality of the date and time of proposed blasting, should be included in the EIA. Blasting should not occur during hours of darkness or at weekends.

Consideration should be given to adopting noise reduction measures recommended in the EPA's 'Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006' in particular those relating to adequate screening of the site, maintenance of plant and machinery, reducing truck movements within the site and efficient methods of blasting. Details of the proposed noise mitigation measures to be employed should be included in the EIA.

The EHS recommends that reference is made by the developer to the EPA's 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities NG4' (January 2016). The existing background noise level should be considered when assessing the impact of noise from the proposed development on local receptors and when setting ELVs.
Details of the location and frequency of noise monitoring should be included in the EIA to be submitted as part of the Planning Application.

Staff Welfare Facilities

If it is proposed to provide staff welfare facilities details must be provided in the EIAR as to how it is proposed to dispose of any waste and effluent generated from such facilities.

Public consultation

The EHS emphasises the need for early and meaningful public consultation in the development process. Accurate information should be obtained regarding the location of sensitive receptors referred to above. There should be on-going engagement with these receptors during the EIA process and the EAIR should detail proposals for keeping sensitive receptors informed and any measures to be employed during the operational phase for dealing with enquiries and/or complaints from members of the public.

The future use of the restored site should be included in the public consultation process.

Site operation times should be agreed as part of the consultation process with local residents.

Potential for future health gain from the restoration of the proposed development

A Decommissioning and Site Restoration Plan for the proposed extraction facility should be put in place. The potential to provide a facility on site which will provide an opportunity for health gain for

the wider community should be considered, for example, walkways, cycle paths, woodland paths, pitch and putt course or an amenity park including a number of these options.

Due to the potential risks associated with swimming in decommissioned quarries, a restoration option which involves the infilling of the quarry would be preferred.

Cumulative impacts of developments in the locality

Other extraction and quarrying facilities within a 5km radius of the proposed facility should be identified and assessed when considering the potentially significant cumulative impacts from the proposed development. The EIA should include cumulative traffic, noise, dust and hydrological impacts.

Any queries in respect of this scoping report should be forwarded to Mr Paul Harrington Principal Environmental Health Officer at the above address

Seamus Mitchell
Senior Environmental Health Officer
Galway

Caroline Hueston
Environmental Health Officer
Environment Operational Unit

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Mr. Thomas Blackwell
MKO Ltd.
Tuam Road
Galway
H91 VW84

Dáta | Date	Ár dTag | Our Ref.	Bhur dTag | Your Ref.
29 November 2019	**TII19-107927**	**180918**

Re: Pre-Planning EIA Consultation for proposed Coshla Quarry Extension, Barrettspark, Co. Galway on behalf of Coshla Quarries Ltd.

Dear Mr. Blackwell,

Transport Infrastructure Ireland (TII) acknowledges receipt of the above EIAR consultation document of 15 November 2019 in respect of the above proposed project.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid application referred.

The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidance as outlined in the Spatial Planning and National Roads Guidelines for Planning Authorities (2012). Regard should also be had to other relevant guidance available at www.TII.ie.

Maps submitted (figures 2.1 and 2.2) are indicated at 1:5000 and 1:200,000 respectively. In this regard, it is not clear whether the application boundary indicated includes the existing quarry void and further lateral extension areas or just the existing void.

TII therefore advises that it is unable to provide substantive EIAR scoping recommendations as the extent of proposed development is not clear in the Document submitted.

With respect to EIAR Scoping issues, in view of the proximity of the site to the national road network, TII requires demonstration of protection of the M6 at this location.

Yours sincerely,

Natasha Crudden
Regulatory & Administration Unit

Bonneagar Iompair Éireann
Ionad Gnó Gheata na Páirce
Sráid Gheata na Páirce
Baile Átha Cliath 8
Éire, D08 DK10

Transport Infrastructure Ireland
Parkgate Business Centre
Parkgate Street
Dublin 8
Ireland, D08 DK10

info@tii.ie
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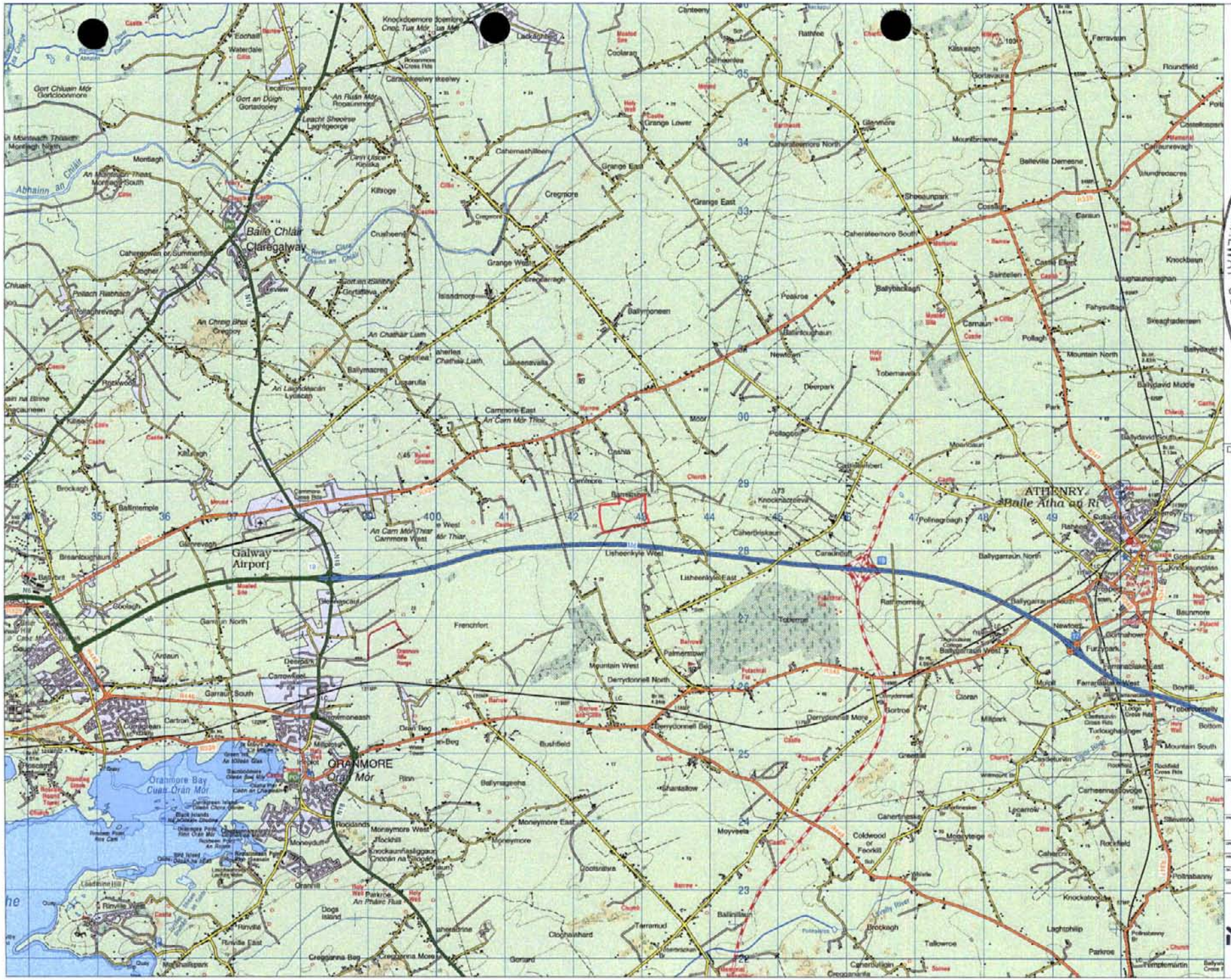
+353 (0)1 646 3600
+353 (0)1 646 3601

APPENDIX 3-1

PROPOSED QUARRY EXTRACTION PLAN



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GALWAY COUNTY COUNCIL

Drawing Legend

Planning Application Boundary

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Location Context Map

Coshla Quarry

Joseph O Brien	Sean McCarthy
180918	180918 - 01
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Website: www.mkoireland.ie

Drawing Legend

Planning Application Boundary

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Site Layout Aerial Map

Coshla Quarry	
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180918	180918 - 02
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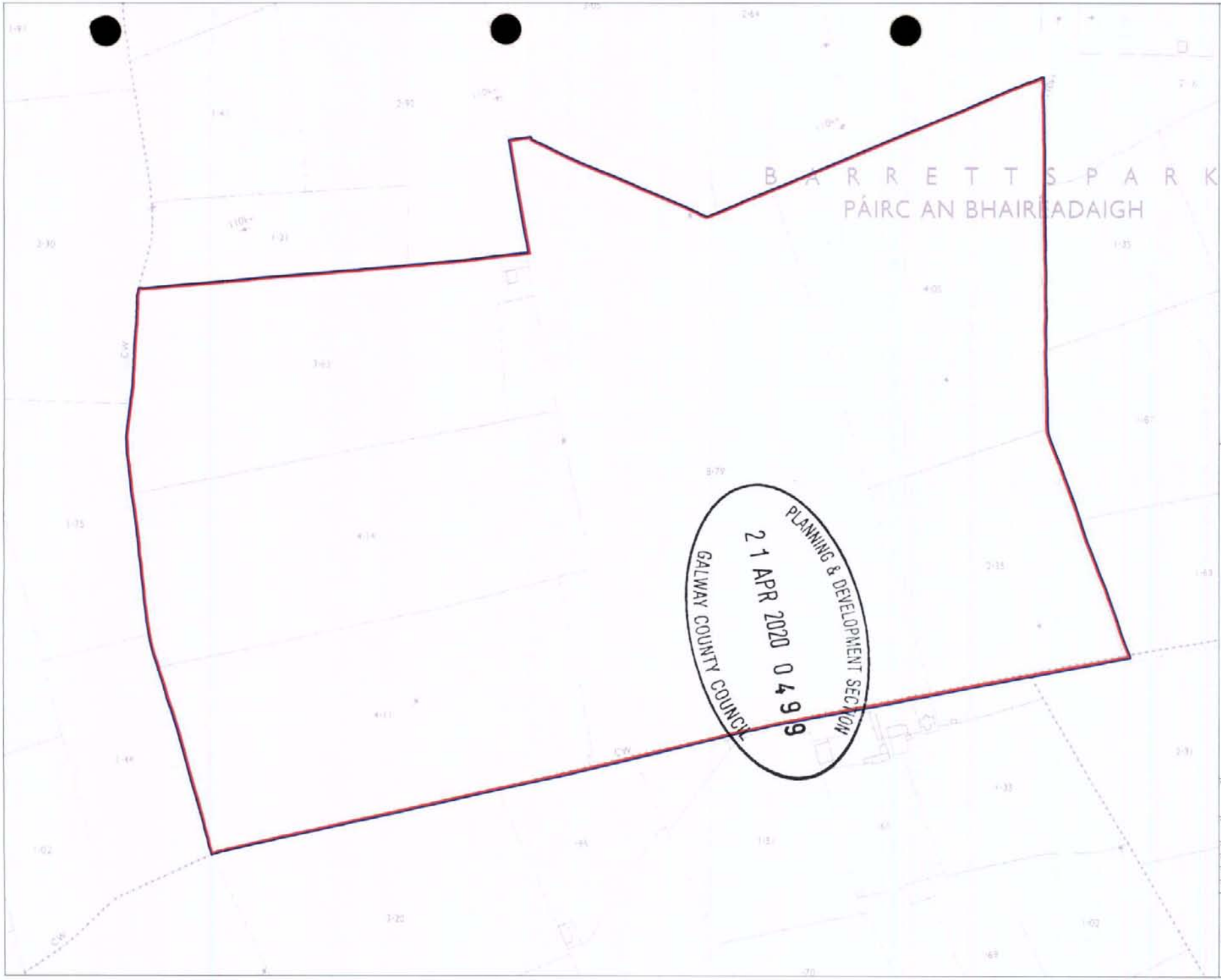

Drawing Legend

- Planning Application Boundary
- Landowners Boundary
- Site Notice

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Site Location Map

Coshla Quarry

Drawn By: Joseph O Brien	Checked By: Sean McCarthy
Project No: 180918	Drawing No: 180918 - 03
Scale: 1:2,500 @ A3	Date: 02.04.2020
OS Sheet No.: 3285, 3286, 3348, 3349	

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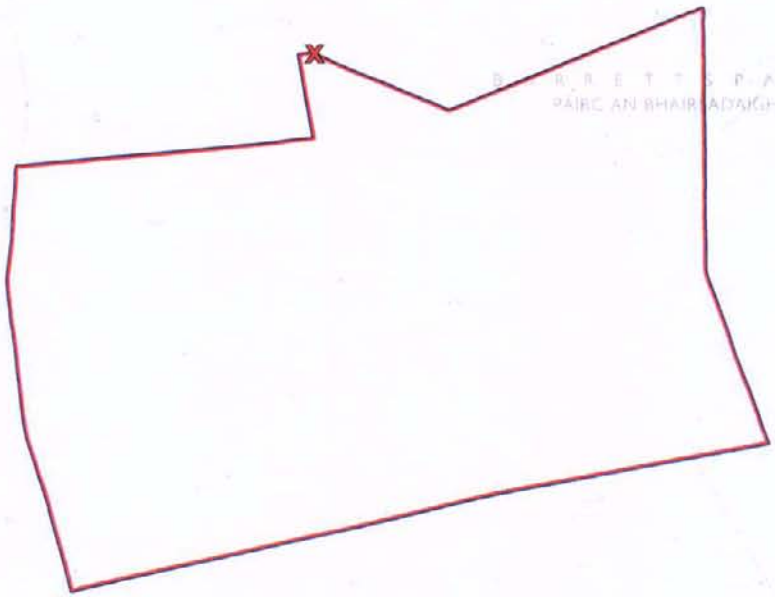
Website: www.mkoireland.ie



Drawing Legend

- Planning Application Boundary
- Landowners Boundary
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DRAWING TITLE

Site Location Map

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DRAWING BY	Joseph O Brien
CHECKED BY	Sean McCarthy
PROJECT No.	180918
DRAWING No.	180918 - 03
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DATE	02.04.2020
OS SHEET No.	3285, 3286, 3348, 3349

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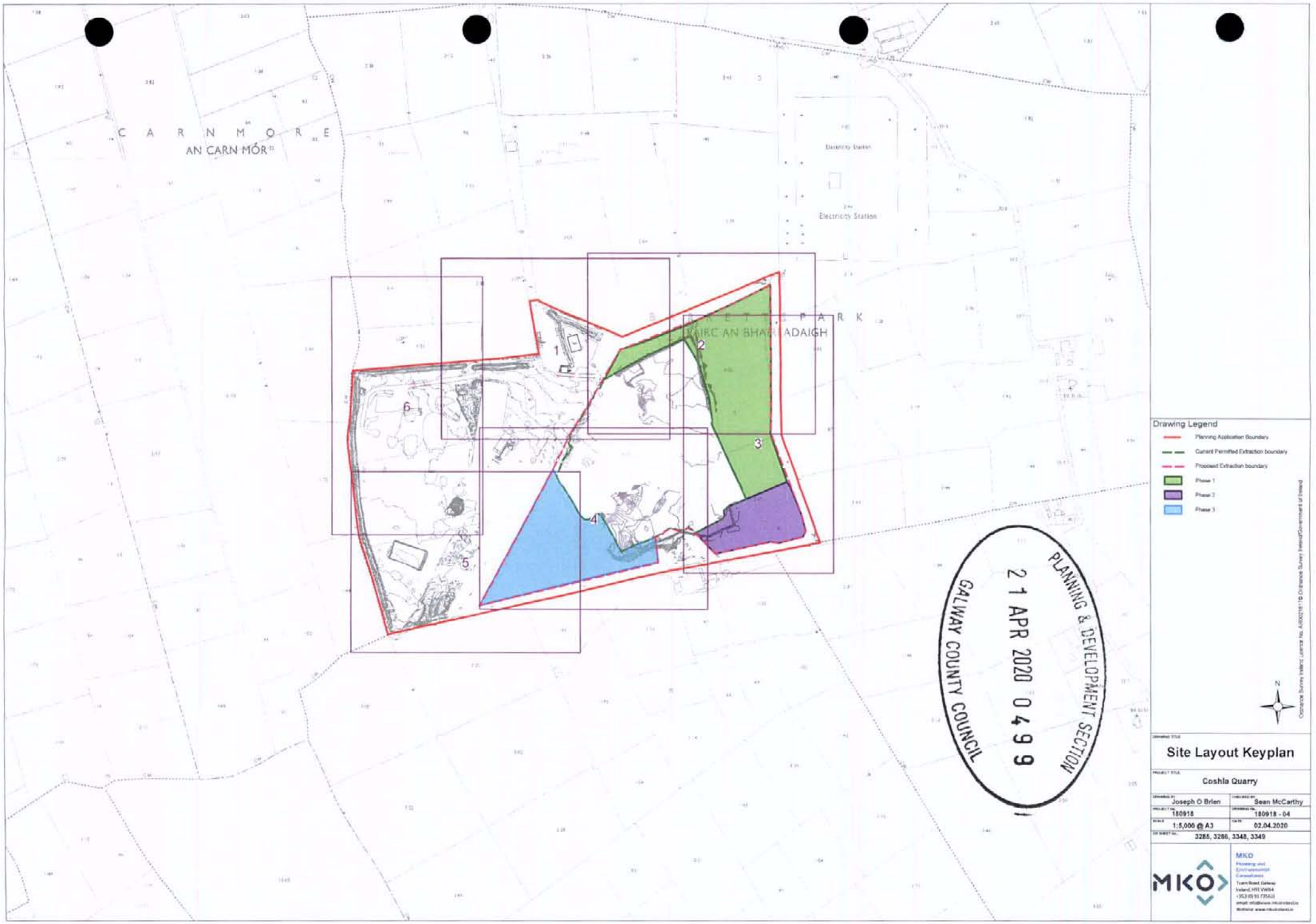

PLANNING & DEVELOPMENT SECTION
21 APR 2020 0499
GALWAY COUNTY COUNCIL

Drawing Legend

- Planning Application Boundary
- Current Permitted Extraction boundary
- Proposed Extraction boundary
- Phase 1
- Phase 2
- Phase 3

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Site Layout Keyplan

Coshla Quarry

Joseph O Brien	Sean McCarthy
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email: info@mkoireland.ie
Website: www.mkoireland.ie

Drawing Legend

- Planning Application Boundary
- Current Permitted Extraction boundary
- Proposed Extraction boundary
- Phase 1

Site Layout Plan
Sheet 1 of 6

Coshla Quarry

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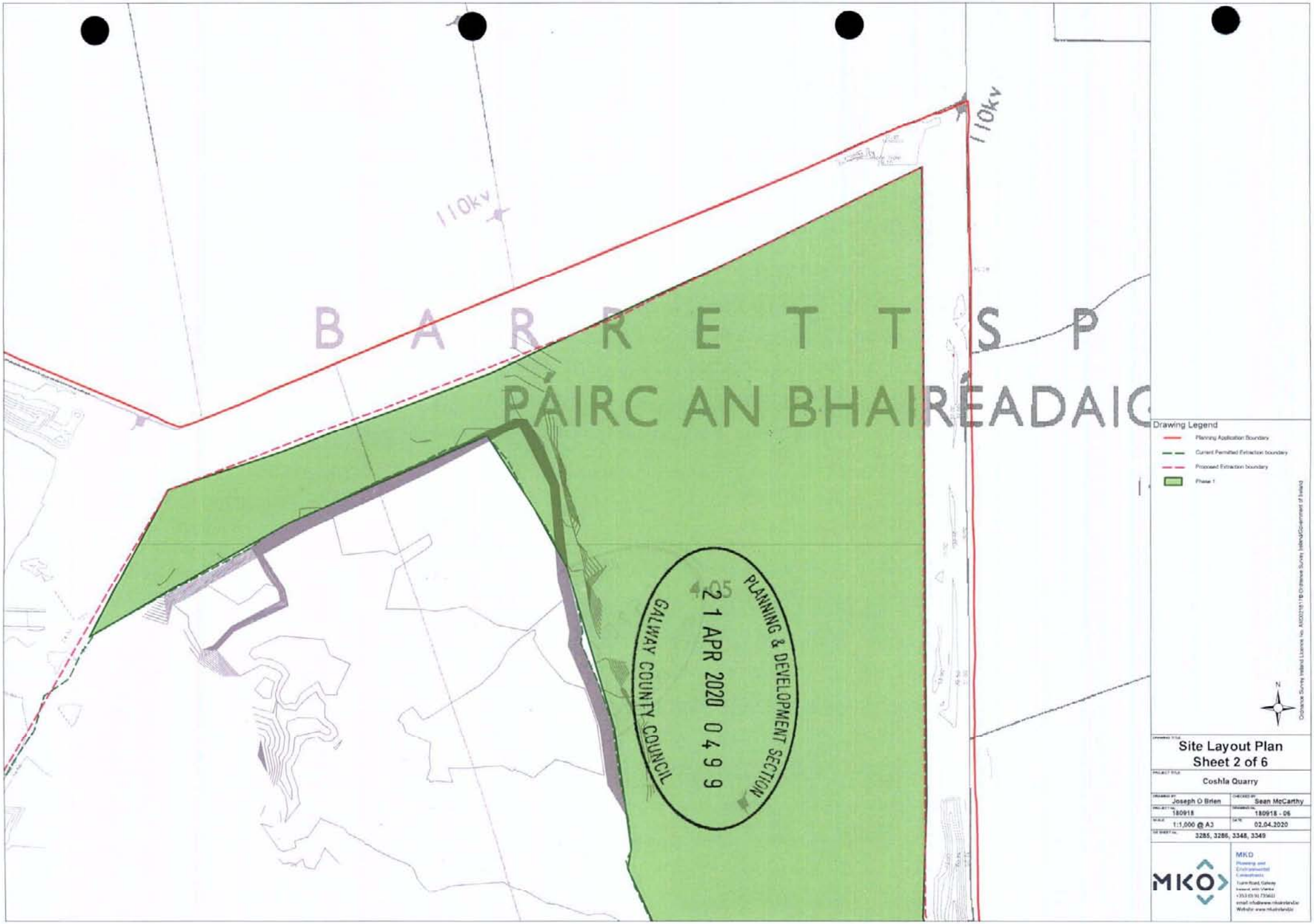
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Coshla Quarry
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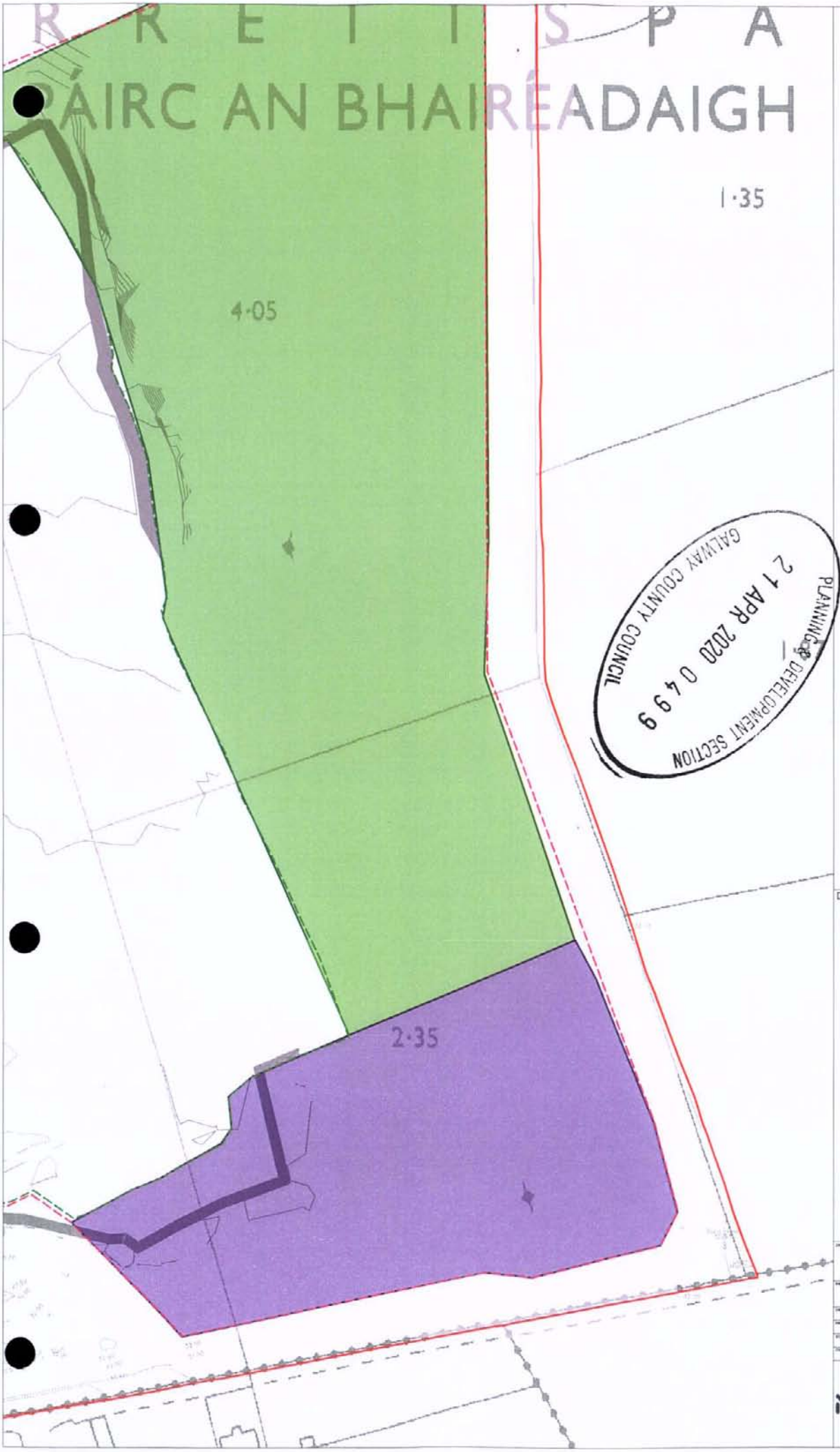

Site Layout Plan
Sheet 3 of 6

Coshla Quarry	
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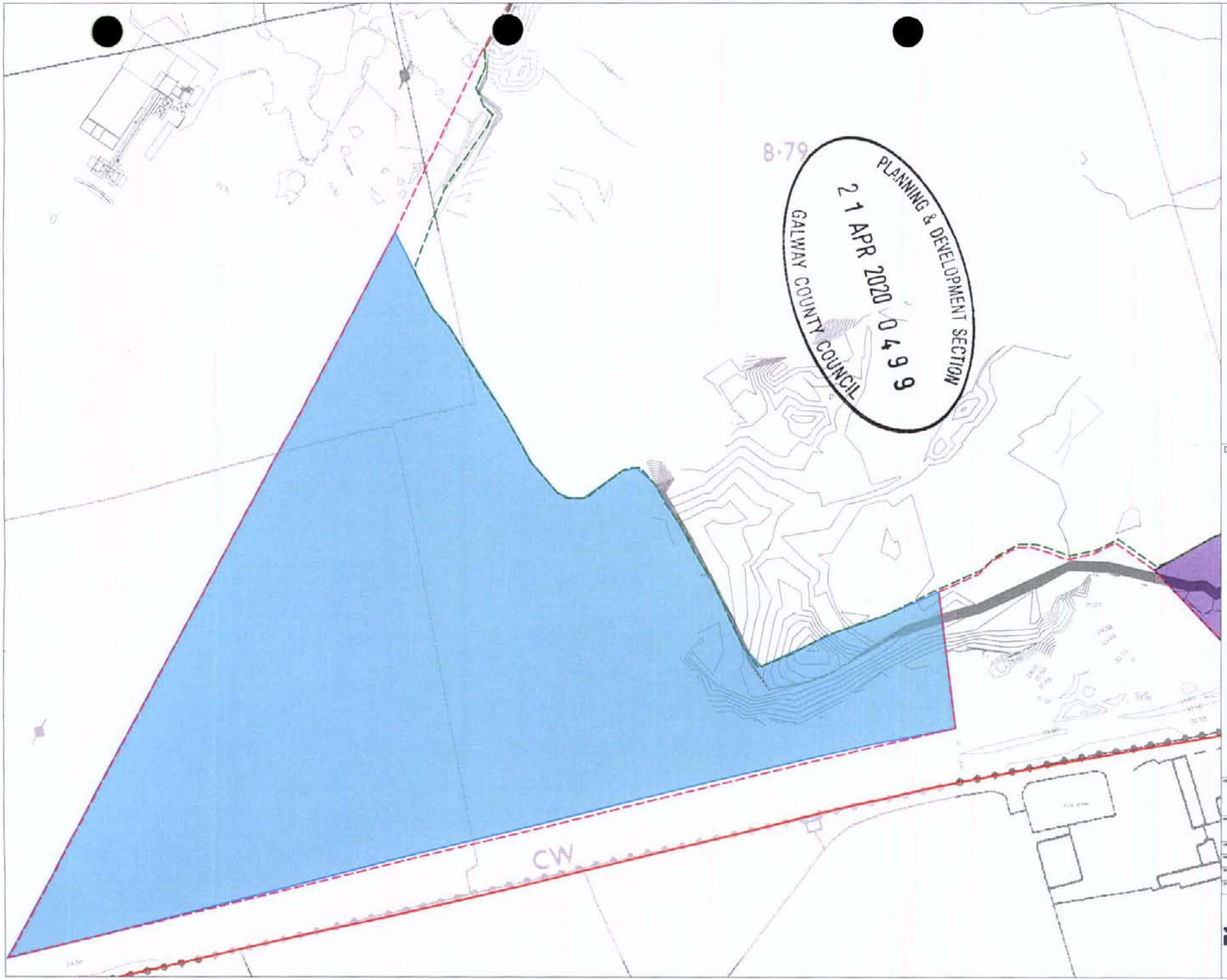

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- Current Permitted Extraction boundary
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- Phase 2
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Site Layout Plan
Sheet 4 of 6

Coshla Quarry

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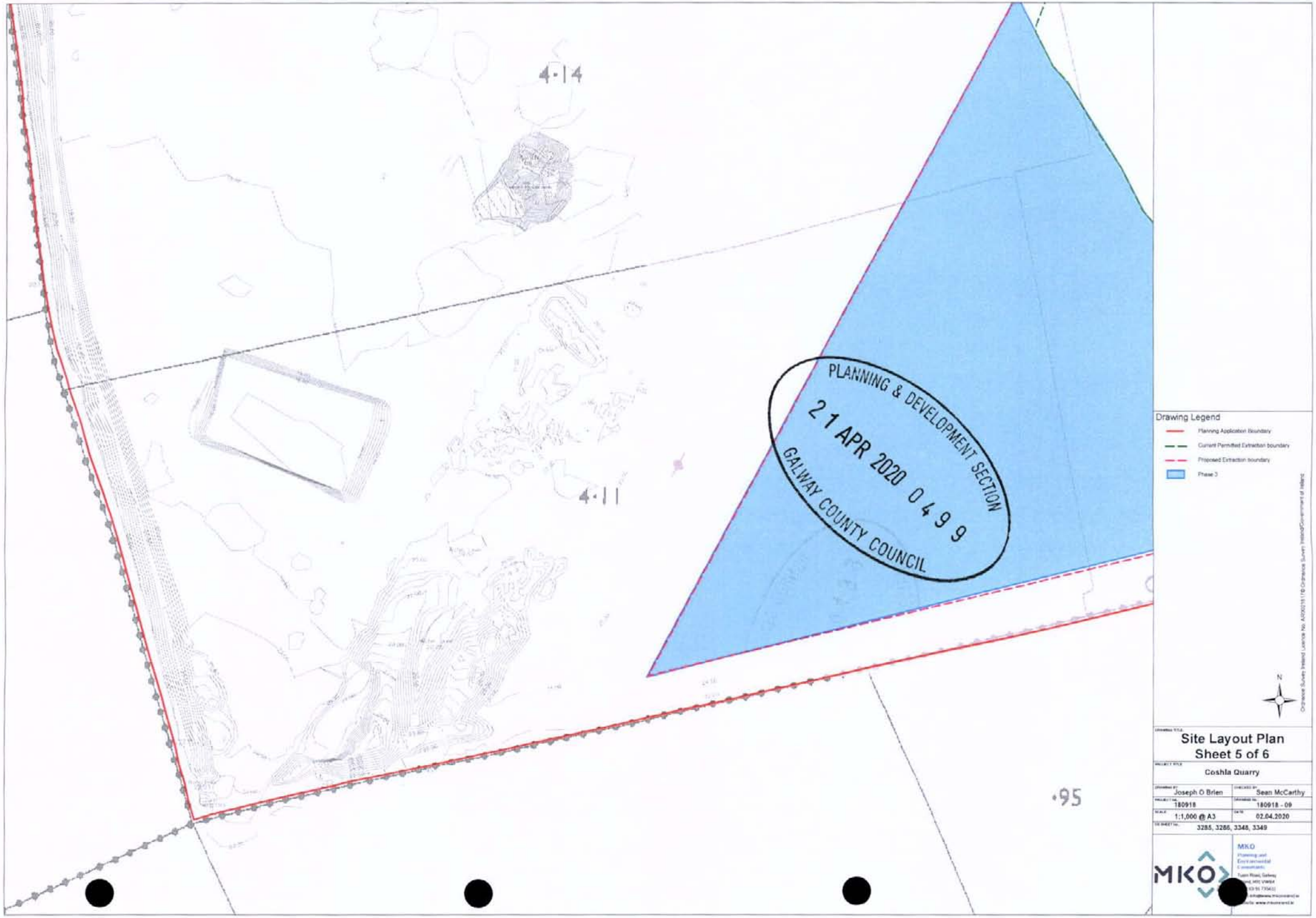
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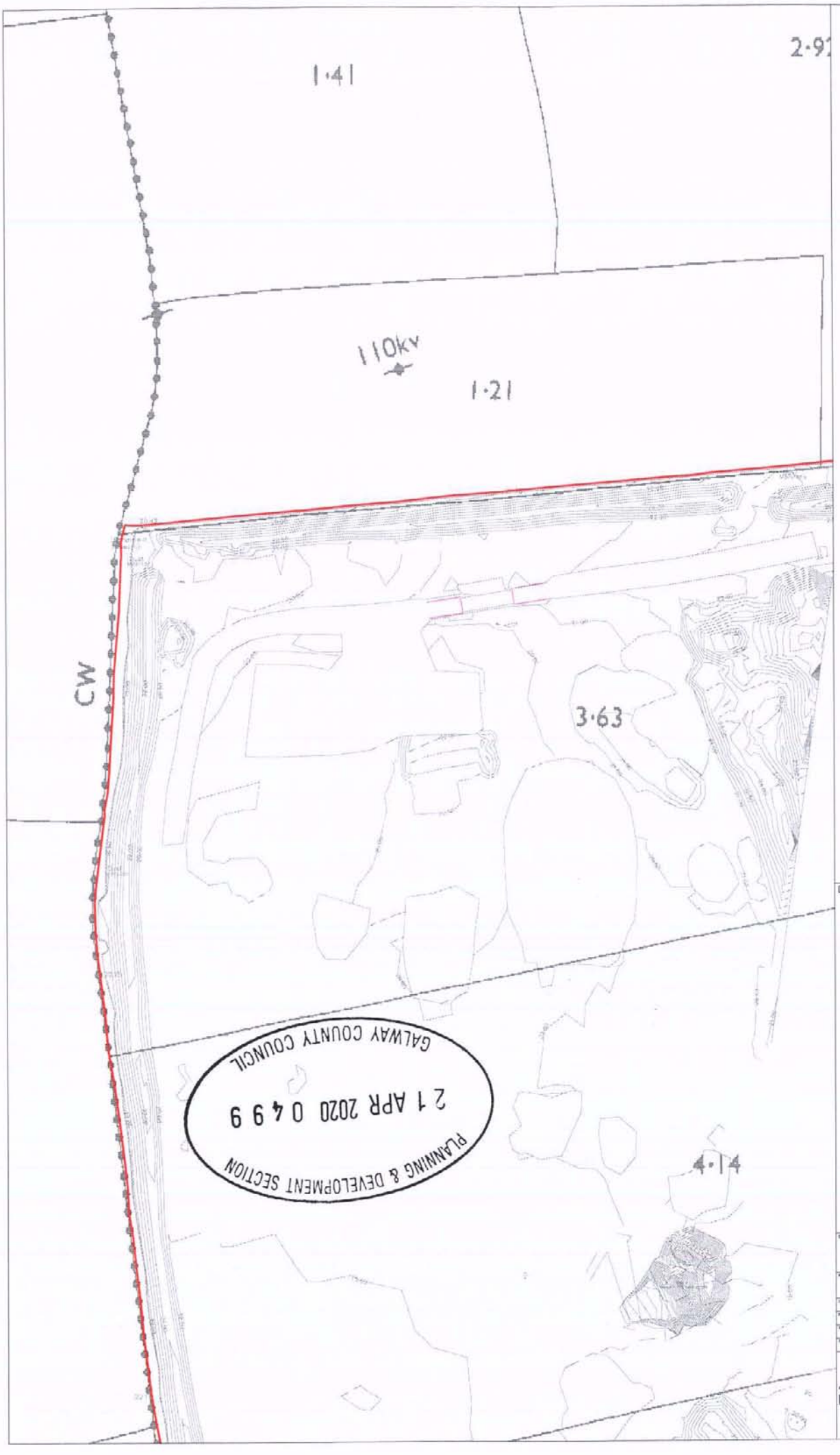

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Sheet 3 of 6

Coshla Quarry

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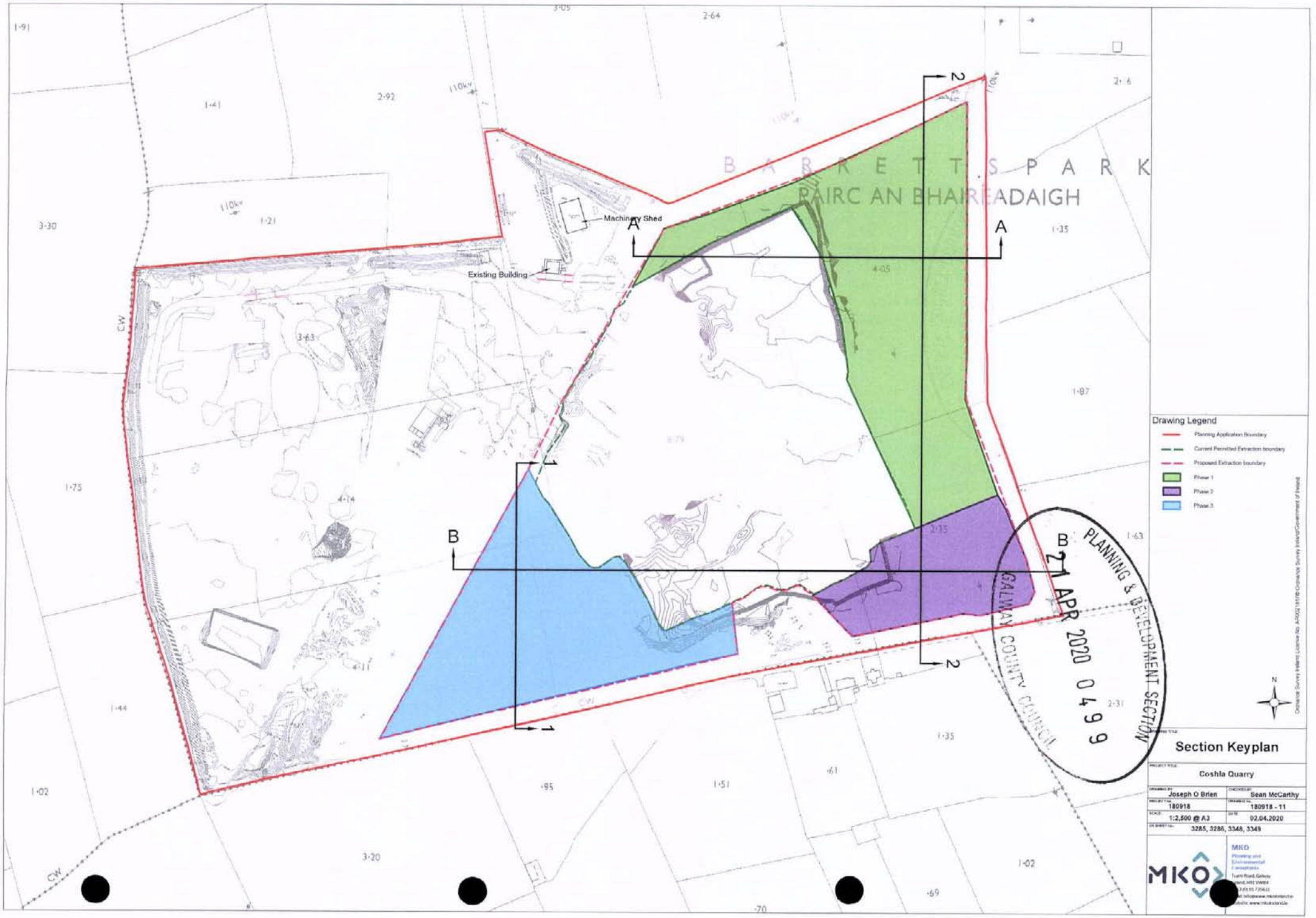
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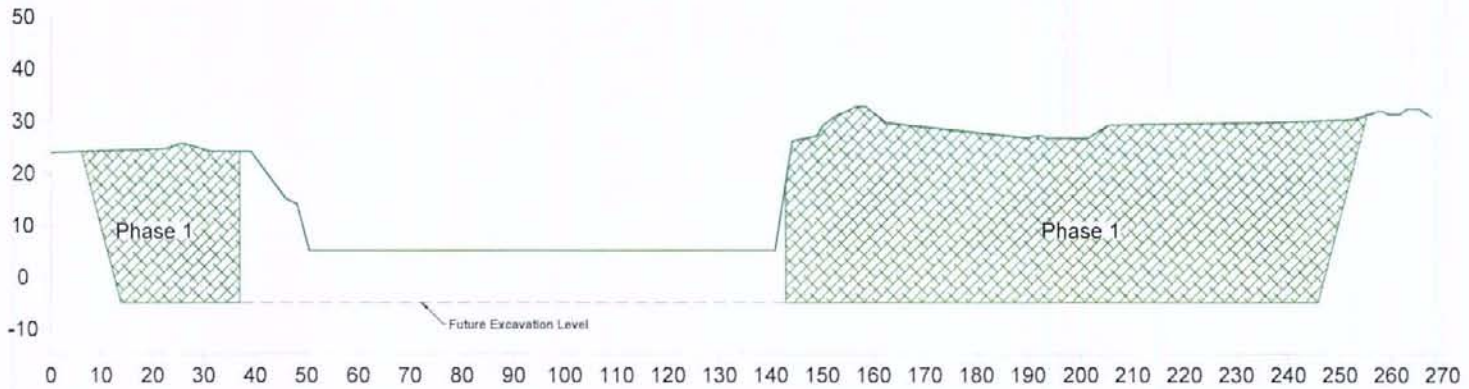

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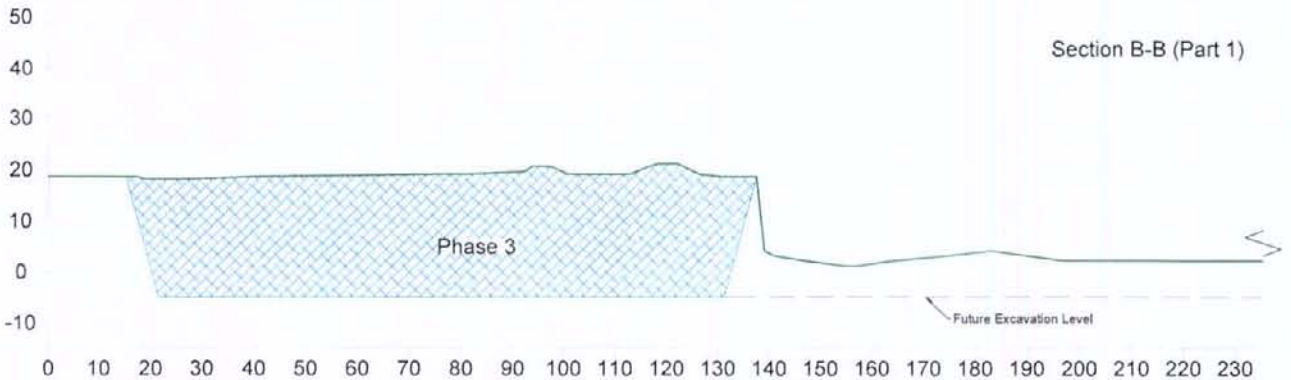

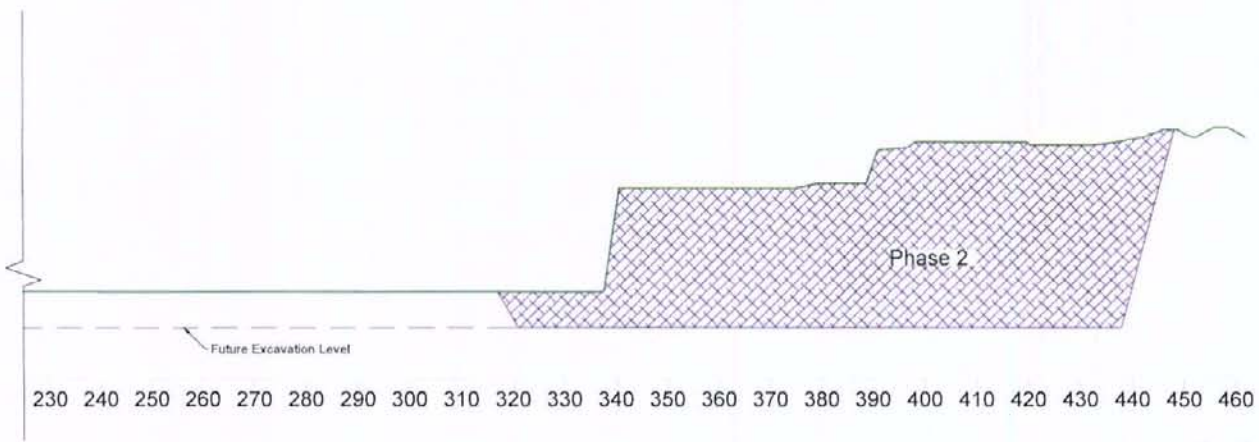

Section B-B (Part 2)

Section A-A & B-B

Coshla Quarry

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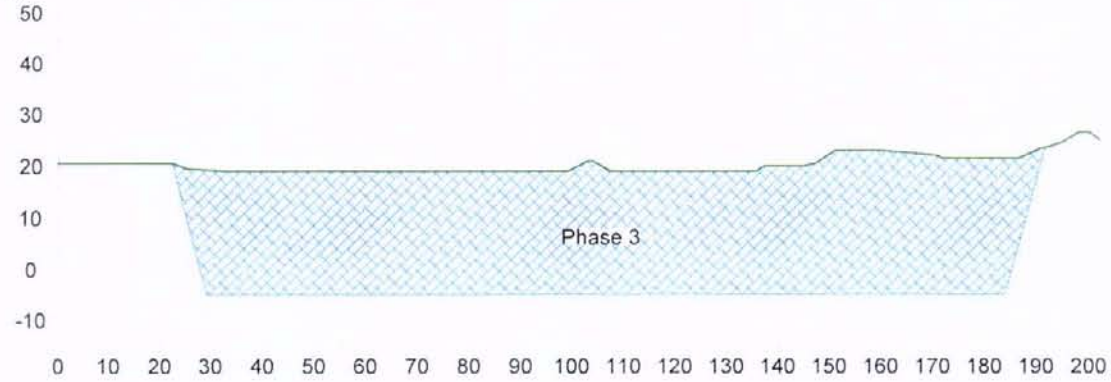
Section 1-1



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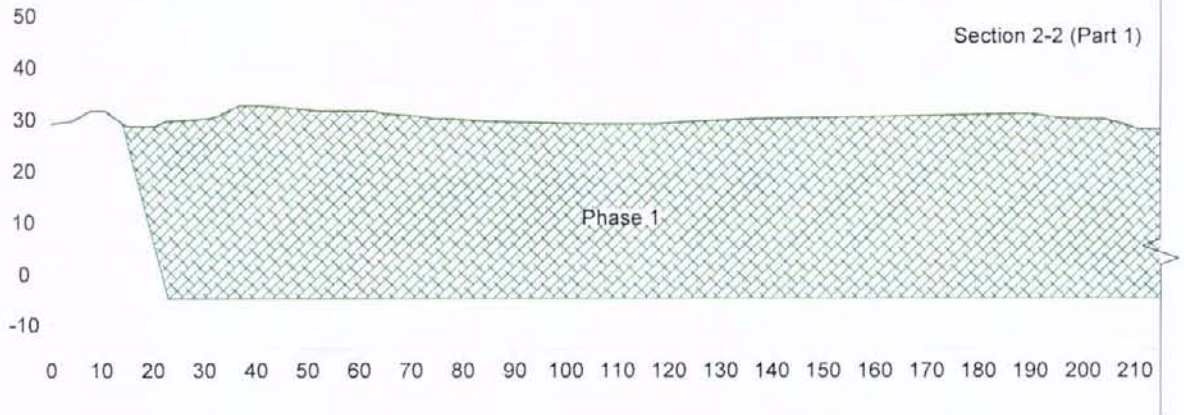

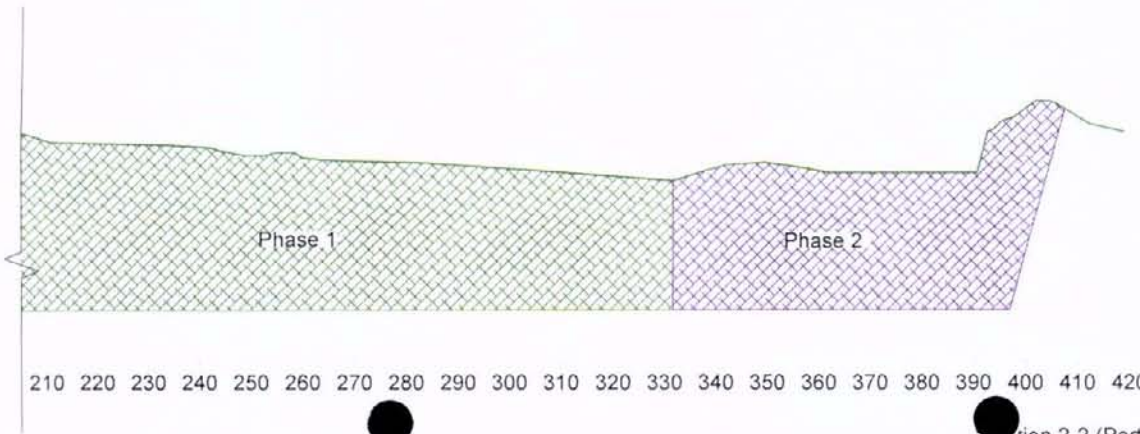

Section 2-2 (Part 2)

Section 1-1 & 2-2

Coshla Quarry

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APPENDIX 3-2

QUARRY RESTORATION PLAN

PROPOSED RESTORATION MANAGEMENT PLAN FOR COSHLA QUARRY, BARRETTSPARK, ATHENRY, COUNTY GALWAY

Planning Authority Reference P09/1958
An Bord Pleanala Reference PL 07.235821 (Bp 91)

Operation of a Limestone Quarry at,
Barrettspark, Athenry, County Galway.

October 2010

Compiled on behalf of
Coshla Quarries Ltd.

Compiled by
INIS Environmental Consultants Ltd
Edenvale, Ennis, County Clare, Ireland
Tel/Fax: +353 (0) 65 6842465
Mobile: +353 (0) 87 2831725
+353 (0) 86 3966868
www.inisenv.ie

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APPENDICES

Appendix I Illustrative plates of restoration works previously managed by INIS Environmental Consultants Ltd.

Appendix II Supporting planting information and planting guidance documents.

Appendix III Seed specifications of all proposed planting mixes.

Appendix IV Restoration plan drawings and sections:

- Figure 1 Present site layout;
- Figure 2 Proposed restoration layout plan;
- Figure 3 Sections of final quarry faces;
- Figure 4 Visual screening and elevations from N6.

1 PREAMBLE

INIS Environmental Consultants Ltd. have been commissioned to produce a Restoration Management Plan for the currently operational quarry at Coshla Quarries Ltd, Barrettspark, Athenry, Co. Galway. This Restoration Management Plan is submitted to An Bord Pleanala as part of a reply to the Boards Further Information request dated 5th July 2010.

This Restoration Management Plan and its associated drawings are comprehensive proposals and outline management procedures to minimise the visual impact of the operational quarry and the proposed aftercare of the quarry following the closure of the site.

The Restoration Management Plan proposes immediate works for the visual screening of the site and additional restoration works for the long term wind down of operations at the site. Proposals including management and landscaping plans are provided in this Restoration Plan to direct, manage and realise both the short term and long term reinstatement of the quarry. Details and management directions regarding immediate screening works, the final phases of extraction works, proposals for long term site layout, restorative surface landscaping, site vegetation planting, site clean up and site security are all provided. All aspects of proposed significant and valuable restoration of the Coshla Quarry site have been outlined here and all management procedures necessary to achieve effective restoration have been outlined here. Every detail of every aspect with relative guidance can be quickly referenced within this report for all staff/ operators/ contractors who would be involved in any works associated with the proposed site restoration. This Restoration Management Plan offers the opportunity to reinstate the site for valuable biodiversity and agricultural proposes, while offering the opportunity for further amenity.

This Restoration Management Plan report outlines the work as it is to be carried out in a phased programme over the operational life and towards the end of the operational life of the quarry to ensure that the restoration of the quarry lands will be implemented in accordance with the proposed landscaping and habitat creation goals/ targets recommended in this report.
The management of restoration is divided into four phases.

The Restoration Management Plan was created with reference to and guidance from all applicable literature. 'Ecological Landscape Design' (NRA, 2000) is one of the approaches promoted and applied in the selection of appropriate landscape treatments for the Irish national road schemes, some aspects of this approach are applicable here and the Ecological Landscape Design concepts have been reviewed and incorporated where applicable. In accordance with Ecological Landscape Design and to enhance the effectiveness of the restoration process, this Restoration Management Plan promotes the use of native species

from indigenous seed stands in an environmentally sustainable and cost-effective way so as to produce long-term self-sustaining landscape treatments. This use of native species is an objective of national and international policy, including the *National Biodiversity Plan* (2002) and the *UN Convention on Biological Diversity* (1992), and contributes to Ireland's commitments under the EU Habitats Directive, 92/43/EEC. An 'ecosystem approach to landscape treatments, developed through Ecological Landscape Design, provides a 'method for sustaining or restoring natural systems and their functions and values' (NRA, 2000).

Specialist Company OGE Hydrogeology Ltd., have been commissioned to produce two focused quarry site assessments which have provided recommendations for this Restoration Management Plan, they include:

- Flood Risk Assessment carried out according to the Flood Risk Management Guidelines for Planning Authorities (according to DEHLG & OPW, 2009), OGE Total Water Management Report, Sections 1 to 17,

- A Hydrology and Hydrogeology assessment with a groundwater assessment for the locality, OGE Total Water Management Report, Sections 18 to 27.

These OGE assessment criteria are submitted in one report submitted with this ABP reply.

Will the Restoration Plan cause any future flooding?

It is very clear to Coshla Quarries that the objectors to the quarry are of the opinion that the quarry is responsible for the November 2009 flooding events and that the quarry also poses a pollution risk to groundwater's. The OGE Hydrogeology Ltd assessments have been directed to establish the scientific facts regarding the reasons for flooding in the area and to establish whether or not the quarry or any pumping operations at the quarry caused or exacerbated flooding in the area. In addition the OGE Ltd assessments have been carried out with particular cognisance towards providing long term recommendations for the reinstatement of the site that will not create any future flood risk given the nature of the 2009 flood event. The complete OGE Hydrogeology Ltd assessment work is submitted as a stand alone report with this Restoration Management Plan as part of the overall An Bord Pleanala (ABP) submission.

The An Bord Pleanala reference number is PL 07.235821.
The Galway County Council Planning reference number is P09/1958.

The present and proposed layouts of the site at Coshla are provided in Appendix IV. Sections of the proposed final quarry faces following restoration are included as are all details and proposals relating to site planting. The proposed visual screening of the site from the N6 is also illustrated in Figure 4, Appendix IV.

2 STATEMENT OF AUTHORITY

Various consultancies have been involved in studies associated with the production of the Coshla Quarries Restoration Management Plan. INIS Environmental Consultants Ltd have developed this restoration plan with direct input from various specialist companies. These companies and their backgrounds/ qualifications are listed below. INIS Environmental Consultants Ltd has significant experience with restoration of limestone rock and 2C (soil and stony matter) quarries here in Ireland. We have been involved in several quarry projects from the planning stages right through to the site clean up and restoration works. Information and photographic evidence of such projects is provided as part of this report (see Appendix I). In addition INIS have sourced pertinent restoration information from additional sources which included UK and US publications on quarry and mineral extraction restoration projects and restoration guidance.

INIS Environmental Consultants Ltd.

INIS Environmental Consultants Ltd. specialise in planning applications and documentation relating to same i.e. EIS investigations, Appropriate Assessments, further information requests, clarifications and An Bord Pleanala submissions. INIS consultants involved in the production of the planning application and this An Bord Pleanala submission are Keith Neary and Howard Williams. Both consultants have significant experience with limestone quarry planning, assessment and compliance right through to quarry restoration and reinstatement. Illustrative plates of quarries which INIS consultants have previously been involved in restoring are provided in Appendix I.

Howard Williams CEnv CBiol MBiol MSB MIEEM completed his B.Sc. in Biological Sciences, National University of Ireland Cork, in June 1997. Following his degree he worked as a biologist for three years (1997-2000). Mr. Williams has acted as lead ecologist on thirty two wind farm developments in Ireland and the UK since 2000. Mr. Williams is a full member of the Institute of Ecology and Environmental Management (IEEM). He is a Chartered Environmentalist (CEnv) with the Society for the Environment (Soc Env) and a Chartered Biologist (CBiol) with the Society of Biology. Mr. Williams is principal consultant with INIS Environmental Consultants Ltd and currently project manager on all INIS projects in the Republic of Ireland and the UK.

Mr. Keith Neary BSc Env Sc (Hons), Dip, FETAC, AIEEM. He completed his degree at University College Cork and produced a final year project on the quality status of recreational waters in the greater Cork area. Mr. Neary has worked on numerous environmental assessments relating to noise, dust and water quality. He is an Associate member of the Institute of Ecology and Environmental Management (IEEM).

INIS Environmental Consultants have extensive expertise and experience in the area of quarry restoration. Examples of limestone quarry sites at which INIS have provided

restoration management are included in this Restoration Management Report. INIS have produced this Restoration Management Plan in consultation with OGE Hydrogeology Ltd for this An Bord Pleanala reply.

O'Neill Groundwater Engineering Hydrogeology Ltd.

Shane O'Neill EurGeol, PGeo, Dip, CECLA carried out the hydrological and hydro-geological assessment work. Mr. O'Neill holds a B.A. (Mod) Geology from Trinity College Dublin, M.Sc. (Hydrogeology) and Diploma in Hydrology, University College London, and Higher Diploma in Civil Engineering Contract Administration and Law, Trinity College Dublin.

His memberships include professional membership of the Institute of Geologists of Ireland, professional membership of the Federation of European Geologists, and membership of the International Association of Hydrogeologists and the National Ground Water Association of America.

O'Neill Groundwater Engineering (*OGE Hydrogeology Ltd*) carried out the flood risk assessment, hydrological, hydro-geological assessments and hydrologic calculations necessary to address the further information requests outlined in parts 2, 3, and 4 of the An Bord Pleanala further Information request letter dated 5th July 2010 i.e.

'(2) ....Flood Risk assessment according to the Flood Risk Management Guidelines for Planning Authorities (DEHLG & OPW, 2009).' .....and.....

'(3).....Adequately examine the interaction of the quarry with groundwater ...and.....implications for restoration and groundwater protection.....the restoration strategy for the site.....including monitoring of ground water levels.....The assessment should provide greater clarity in relation to the management of wash down waters associated with the concrete batching plant, and any other effluents arising on site, ensuring no pollution is caused.....and.....

'(4).....Specific proposals in relation to restoration and aftercare of the site. The applicant is requested to prepare comprehensive proposals in this regard, which should be developed having regard to the outcome of the response prepared to hydrogeology and flooding'.....

OGE Hydrogeology Ltd have also provided their expertise in the areas of surface water management, mitigation and monitoring to propose additions to the operating surface water management plan with associated proposed infrastructural upgrades to ensure protection of groundwater's. Monitoring of groundwater's (via boreholes) and surface waters are included in the OGE assessment and proposed monitoring plan.

OGE has been in operation as a hydro-geological consultancy since 1996 and provides specialist advice in ground water (hydrogeology), surface water (hydrology), well drilling and

borehole testing. OGE have extensive expertise in hydrogeology in the quarrying, mining, bottled water, food, drink, planning and environment sectors. OGE is one of Irelands leading independent consultants in hydro-geological assessment.

Control Surveys

Control Surveys is a fully insured land and building surveying company based in Dooradoyle, Limerick. A member of the Irish Institute of Surveyors and with clients nationwide, Control Surveys have worked on a diverse range of projects over the past number of years and have built a reputation for providing a quality, reliable and professional service to our clients. By employing the latest GPS and optical technologies available, Control Surveys provides high quality, individualized survey services. The highest degree of detail can be provided by Control Surveys. All natural features such as trees, earth mounds, water courses, high/low points etc and man made features such as roads, fences, paths, services etc. are surveyed using the latest technology available namely GPS and Robotic Total Stations.

BMA GeoServices Ltd.

BMA GeoServices offer a wide range of geophysical, geotechnical and environmental services. Applying expertise and appropriate earth scientific and engineering technologies. BMA has experienced professionals in geology, geophysics, geotechnics, hydrogeology, environmental science and engineering. BMA has carried out a full Geotechnical Assessment of the quarry.

All Rock Drilling & Blasting Ltd.

Martin J Nee, Shannaheever, Clifden, Co. Galway, Ireland. Fully licensed and insured. Full and complete technical expertise is provided on all aspects of blasting and blast monitoring. Special expertise and experience is available for urban blasting in sensitive and densely populated areas.

NVM Ireland Ltd.

National Vibration Monitoring Ltd (NVM Ltd. Ireland) is Ireland's leading geotechnical and structural monitoring firm, with over 15 years' experience in all fields of monitoring. NVM Ltd. engineers can provide unrivalled accuracy of noise, dust and vibration surveys using equipment from the world's leading manufacturers of data acquisition and monitoring instruments. With the installation of NVM Ltd. systems, clients can continuously monitor many environmental variables.

NVM specialise in the effective monitoring of noise, dust, and vibration. NVM also provide water and soil sampling services and a wide variety of geo-technical equipment and installation services. NVM Ltd. offer excellence as a standard, providing quality and accuracy in all aspects of their services.

3 PLANNING HISTORY OF THIS SITE

On the 25th September 2006 Coshla Quarries Ltd acquired Planning Permission (P06/4125) to operate a quarry at Barrettspark, Cashla, County Galway. The original planning permission was due to elapse in 2011. As with any commercial venture forward planning identified that the quarry was still economically viable and the company made a commitment to the initial quarry investment and to its staff to continue operating.

The 2006 EIS (P06/4125) submitted for planning outlined that the quarry had a rock resource of 30 million tonnes before the site would require significant reinstatement. In the initial (P06/4125) planning application the proposed extraction area allowed for a rock resource of 8 million tones, and to date just over 2.5 million tonnes of this volume has been extracted. While demand for construction products has slowed, the quarry at Coshla is still economically viable and a significant remaining resource of just over 5 million tonnes remains at this site and within the originally granted P06/4125 extraction area. It is Coshla Quarries Ltd, decision to ensure the operation continues until the initial extraction area outlined in P06/4125 is fully exploited (8 million tones total). Coshla Quarries Ltd as part of its long term commitment to the site and the operation therefore made the P09/1958 application for planning to continue quarrying at the site for a further 10 years.

This commitment included the production of an Environmental Assessment document as part of the planning application for an additional ten years operation at the site.

The operator (Coshla Quarries Ltd) consequently carried out a new planning application (P09/1958) for the site with an accompanying set of environmental impact surveys/ assessments for noise, dust, water, ecology etc. Rather than risk excessive FI requests the operator (Coshla Quarries Ltd.) carried out all surveys usually carried out as part of an EIA/ EIS and to a level deemed necessary for the extent of the quarry operation. These various assessments (noise, dust, air quality, ecology, water quality and site management/ mitigation etc.) were collated together into the format of an Environmental Impact Assessment to allow for simple dissemination and to present all information in an accessible and easily referenced manner as opposed to submitting a significant number of separate documents. The operator has gone beyond its remit in providing a single assessment document which collates all the separate assessment work carried out at the site and cross references all potential impacts where relevant to provide a complete and easily digested document with a non technical summary. In addition to the Environmental Assessment work carried out for the planning application, this Restoration Management Plan is now produced and submitted as part of the original planning application conditions and as part of the overall site management plan.

To achieve this, the assessment document has been prepared with direct reference to the policies and requirements of the Galway County Development Plan (2003-2009) and in accordance with the recommendations of the Environmental Protection Agency's (EPA)

Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) and *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA, 1995) and with reference to the draft Galway County Development Plan 2009 – 2015. In addition other publicly available information sources and guidance documents have been reviewed and referenced in the retention planning application document where relevant. They include:

- "Advice Notes on Current Practice (in the preparation of an EIS)";
- "Guidelines on the Information to be contained in Environmental Impact Statements"(2002);
- "Environmental Management in the Extractive Industry: Non-Scheduled Minerals" (from Project Report no. MS-2000-M1 by John Barnett and Associates Ltd. For the EPA, in preparation, 2004).

Other relevant guidance referred to during the production of the planning document included the following documents:-

- European Asphalt Pavement Association (EAPA), Best Available techniques (BAT) for production of Asphalt Mixes;
- "Geology in Environmental Impact Statements – a Guide" (2002). U.K. Department of the Environment, Transport and the Regions;
- "Mineral Planning Guidance Note 11: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England – Consultation Paper" (2000). Landscape Institute/Institute of Environmental Management and Auditing (UK);
- CIRIA - Environment Agencies Joint Guidelines: Pollution prevention guidelines. Use and design of oil separators in surface water drainage systems: PPG 3 (2006);
- CIRIA - Environment Agencies Joint Guidelines: Pollution Prevention Guidelines. Above Ground Oil Storage Tanks: PPG2 (2006);
- CIRIA - Environment Agencies Joint Guidelines: Pollution Prevention Guidelines. Above Ground Oil Storage Tanks: PPG1 (2006);
- CIRIA - Environment Agencies Joint Guidelines: Masonry bunds for oil storage tanks;
- CIRIA - Environment Agencies Joint Guidelines: Concrete bunds for oil storage tanks;

Documents reviewed as part of the planning application and as part of this submission include:

- Geotechnical assessment of Coshla Quarries Site, (2008). BMA GeoServices specialist Bernard Murphy MSc, PGeo, EurGeol, MIEI, DIC;
- 'Effects due to Floods in Cashla, Athenry, Co. Galway' report, (2009). Prepared by Savithri Senaratane BSc (Eng), MSc, PhD, MICE, CEng;
- Groundwater in Galway. Daly, D 1985, GSI Publication;
- Groundwater and Karstification in Mid Galway, South Mayo and North Clare, Drew and Daly, 1993, a GSI publication;
- Karst Hydro-Geology and Karst protection, IAH Congress, 1988;
- Clarinbridge GWB Description August 2004- a GSI Draft publication;
- Ballyvaughan GWB August 2004- a GSI Draft publication;
- GSI groundwater response web mapper and associated maps;
- The Geology of Galway Bay; 1:1000,000-scale geological map sheet14;
- OPW Flood Hazard Mapping Tool and associated reports.

4 RESTORATION PLAN DESKTOP REVIEW

All previous pertinent EIS and EA work has been reviewed e.g. water assessments, ecological assessments and infrastructural information. More specifically the OGE Ltd Hydrogeology and Flood Risk Assessment work have been reviewed and particular cognisance is paid to OGE Ltd recommendations re long term reinstatement of the site. Furthermore the following guidance documents and reports on other similar restoration projects were also used in the production of this Restoration Management Plan:

- **Water Based Quarry Restoration - Methodologies, Technologies and Approaches.** Minerals Industry Sustainable Technology Programme Minerals Industry Research Organisation. March 2007.
- **Best Practice Guidelines for Aggregate Rehabilitation Projects - Extracting the Benefits for Species at Risk and Rare Habitat.** Prepared For The Ontario Aggregate Resources Corporation In Association With: Gartner Lee Limited Azimuth Environmental Consulting Inc. February 2008.
- **A procedure to evaluate environmental rehabilitation in limestone quarries**. Ana Claudia Neri, Luis Enrique Sánchez, Escola Politécnica, University of São Paulo, Av. Prof. Mello Moraes, Brazil Journal of Environmental Management. June 2010.
- **A Guide to Landscape Treatments for National Road Schemes in Ireland**. National Roads Authority 2000.
- **Park Canal Restoration Project Limerick.** Part 8 Design Report. White Young Green Consultants Ltd. January 2005.
- **Quarry Rehabilitation - Cliffs, Landforms and Ecology.** S. E. Yundt, M.A., MIQ S. B. Lowe, M.Sc. 2002. The Technical and Research Committee on Reclamation, Society for Ecological Restoration, Restoration Ecology Vol. 9 No. 1. March 2001.
- **UK Minerals Planning Guidance Pollution Prevention Guidance document 7 (PP7): Reclamation of mineral workings.** Department for Communities and Local Government (UK). November 1996.
- **Grass and Clover Recommended List Varieties for Ireland 2010.** Department of Agriculture, Fisheries and Food.
- **Selecting Hedgerow Species.** An Teagasc (2010).
- **Irish Variety Tree Supplies. Forest Service,** An Teagasc & Department of Agriculture, Fisheries and Food (2010).

Websites:

- **Alvars (limestone pavement) and Quarries of Southern Ontario**
  http://www.uoguelph.ca/~jnklab/Field sites.htm
- **Teagasc Planting Recommendations – Forest and Hedge establishment**
  http://www.teagasc.ie/forestry/technical_info/
- **Design by Nature (DBN): Wildflowers.ie**
  http://www.wildflowers.ie/a_dbn_trade_centre/1_wildflower_seed_products_services.htm
- **Woodlands of Ireland**
  http://www.woodlandsofireland.com/events.htm
- **Native Woodland Scheme**
  http://www.teagasc.ie/forestry/technical_info/native_woodland_clare.asp
- **Irish Seed Savers**
  http://www.irishseedsavers.ie/
- **Society for Ecological Restoration International**
  http://www.ser.org/
- **Ecological Restoration Forum**
  http://ecologicalrestoration.info/Water
- **Water Based Quarry Restoration**
  http://www.quarry-restoration.com/
- **Restoration Ecology Network**
  http://depts.washington.edu/uwren/
- **Society for Ecological Restoration Network**
  http://www.globalrestorationnetwork.org/

5 SITE DESCRIPTION

5.1 Coshla Quarries Site

The Coshla Quarries site size (in ownership) is 27.43 Ha. 13 Ha is outlined within the originally granted extraction area. The original datum granted for extraction was -5 mOD. Please refer to maps and site layout drawings attached as scaled planning drawings.
The Coshla quarry site is accessed off a 3rd class country road which is approximately 1.5km from the R339 road. This local road also serves the ESB substation, C&F Tooling works and a number of rural houses and farmland buildings as well as the existing Coshla Quarries Ltd. The principal land use in the area of the development is activities associated with Coshla Quarries.

Based on an area of 1km in radius from the Coshla site approximately 16 structures were encountered where 14 were occupied structures and 2 were either farm or unoccupied structures such as derelict buildings. The nearest occupied private house is about 500m to the east of the quarry boundary. The rest of the private houses which are within 1000 meters of the site are located along the access/ egress road to the R339. The nearest buildings are C&F Tooling and the ESB substation, both located within 500 meters.

The present and proposed restoration layouts of the site at Coshla are provided in Appendix IV. Sections of the proposed final quarry faces following restoration are included. The visual screening of the Coshla site from the N6 is also illustrated.

5.2 Restoration Plan Drawings

Scaled drawing illustrating all aspects of the site and surrounding area are submitted with this application in Appendix IV. The drawings include illustrations of the site as it presently exists and drawing of the proposed restoration scheme with all relevant details annotated. Side elevations, where necessary, are also given. The drawings include:

Figure 1 Present quarry site layout with all infrastructure, boundaries, and topographies;
Figure 2 Restoration plan with proposed planting layout out and all other restoration features;
Figure 3 Sections of final quarry extraction faces and
Figure 4 Visual screening elevations from the N6.

It is highly recommended that the reader of this report become familiar with the details of the submitted drawings. All aspects of proposals outlined and proposed within this Restoration Management Plan report can be identified within the accompanying drawings.

5.3 Landscape Character

According to the Galway County Council 'Land Cover Landscape Character Map' (Galway County Council County Development Plan 2003-2009) the Coshla Quarry site sits in agricultural lands in the East Central Galway region. This 'Character Area' is classified as being 'Class 1 - Low landscape sensitivity' (Galway County Council County Landscape sensitivity Map) and is given a landscape value rating of 'Low' (Galway County Council County Landscape sensitivity Map). These points are highlighted by the local investigations carried out to identify the extent to which the area associated with the quarry can be seen from the surrounding landscape. The 09/1958 visual surveys showed the present asphalt and concrete batching plant set ups are not significantly visible throughout the surrounding area, and importantly the quarry development is not in anyway viewable from any scenic routes (as no scenic routes exist proximal or in the locality). The 09/1958 EA (Environmental Assessment) Landscape and Visual survey therefore validated the points from the Galway County Council Landscape Assessment that the local landscape has the capacity to accept change without excessive visual intrusion or change due to its present landscape character value.

Agricultural access roads running from the R339 south do provide southerly and easterly views into the quarry and the plant is visible. The quarry at Coshla is located within a surrounding landscape which is relatively open and mildly undulating lands and is not prominent in elevation with respect to surrounding lands. The quarry sits at datum's similar to the surrounding lands. The quarry is therefore not highly visible. The various quarry plant (concrete batching plant) becomes visible from locations immediately to the south and from south-westerly viewpoints along the N6 road corridor. Around the site of the proposed development there is presently little vegetation or other landscape features. However the asphalt plant and concrete plants within the quarry site are not visible from the R339 and they are only marginally visible from dwellings around the area due to the undulating nature of the landscape. Both batching plants are visible from the end of most of the agricultural access tracks which run north to south from the R339, i.e. they are visible from areas within 100-200 meters to the north west and north east. Both batching plants are visible as one passes the site along the N6 route. The quarry extraction area itself and its operations are not visible from the N6 route due to the topography between the site and the N6.

Furthermore it must be pointed out that the adjacent ESB sub station is by far the most dominant feature in the area. The adjacent ESB substation dominates the views from the surrounding landscape from all viewpoints; the second most prominent structures in the locality are C & F Tooling Ltd factory and the Newall Roofing Products factory. Visual screening plans to visually screen the site from views off the N6 motorway are given within this report and illustrated in Appendix IV.

5.4 Geology

5.4.1 Subsoil

The area has been stripped of the previously existing shallow topsoil's and subsoil's the quarry site floor is solid limestone bedrock. There are some subsoil's present on site at the north eastern sections of the site and as soil berms around the site perimeter.

5.4.2 Bedrock Geology

Lower Carboniferous Limestone underlies the site and surrounding general locality.

5.5 Flood Risk Assessment Summary (Sections 1 to 17 of the OGE Report)

Summary findings relating to the Flood Risk Assessment from OGE Ltd (OGE Total Water Management Report, Sections 1 to 17) are as follows:

- The *"Planning System and Flood Risk Management Guidelines for Planning Authorities" (DEHLG & OPW, 2009)* were reviewed and interpreted in the context of the Coshla Quarry application. Coshla Quarry would be classified as a "*Less Vulnerable Development*".
- There is no runoff from the quarry operation (see Section 12 and 13).
- The quarry is not located in a flood plain.
- Only the R339 at Carnmore East has been identified as being potentially at risk from flooding.
- The recurrent flooding at Carnmore East and along the R339 road is a drainage issue and is not caused by the quarry nor is it exacerbated by any operations at the quarry including pumping operations. Pumping operations at the quarry are assessed in detail in the OGE report. In addition it is pointed out that the November 2009 flood event which commenced at Carnmore East was a combination of the drainage issue (road and land drainage) at Carnmore and the exceptionally heavy precipitation. Coshla quarry and its operations did not cause, exacerbate or prolong the November 2009 flood event. Hydrological, hydro-geological and flood risk assessments associated with the OGE report indicate that the quarry void ameliorated the flood event by providing a flood water retention area. In addition no other flood risk has been identified in or around the quarry.
- The OGE report demonstrated the Coshla Quarries development has implemented appropriate flood risk mitigation measures that (regardless of the flood event size) do

not exacerbate flooding in the immediate surrounding lands including the Carnmore area. The OGE report demonstrated the Coshla Quarries quarry void area actually alleviated flooding in the immediate surrounding lands including the Carnmore area following the migration of the November 2009 flood waters into the quarry void.

- The type of flooding that occurred in November 2009 was overland flow caused by the volume of rainfall being in excess of the infiltration capacity of the soils. The runoff from the land and in particular the R339 accumulated in hollows and low-lying areas and gradually spread out to the north and south of the R339. The flood waters eventually reached the Coshla quarry site where they were allowed to drain into the quarry void to provide flood relief (a reduction in flood levels) at Carnmore.
- The flood event of November 2009 was a greater than 1:340 year flood event.
- The operation of the Coshla Quarry neither caused the local flooding nor exacerbated the local flooding of November 2009.
- The pumping of the quarries lowest bench (i.e. the quarry sump) neither caused the local flooding nor exacerbated the local flooding of November 2009.
- The presence of the Coshla quarry void provided a significant retention area for flood waters which alleviated the extent and duration of the flood event at the areas around Carnmore East, the final quarry void will provide a water retention area of approximately 3,000,000m^3. The local private landowners should understand this as fact.

5.6 Groundwater Summary (Sections 18 to 27 of the OGE Report)

There are no surface water features within the Coshla quarry, nor are there any proximal to the Subject Site. The nearest surface water feature is the Clare River located approximately 4 kilometres to the North West. Five boreholes exist around the perimeter of the Coshla Quarry site. A private well has been installed in BH5 (PW1) and it supplies water to the quarry (depth 460 feet). It supplies water for on site purposes, Coshla Quarries canteen, wheel wash, dust suppression etc. Surface water run off from precipitation migrates directly into the groundwater and there are no drains at the quarry site.

The proposed site represents no hazard to any surface water resources as none exist in the area. Pertinent summary findings relating to the hydrology, hydrogeology and groundwater's from OGE Ltd (OGE Total Water Management Report, Sections 18 to 27) are as follows:

- No faults have been mapped by the GSI in the area of the quarry. There is evidence of small joints and bedding planes. None of these appear to be significantly weathered. There was no evidence of karstification seen within the extraction faces of

the quarry pit. There was no evidence of significant karst features e.g. conduits etc in the borehole logs. Significant karst features are not expected within the development site area.

- A detailed water balance for the local surface water catchment (see Figure 1, OGE report) has been presented in Section 11 of the OGE Surface Water section.

- On September 27th between 12:28 and 13:15 the water levels were measured in each monitoring well, and at the sump on the Lower Bench, (Table 4 is a summary of the water levels recorded on the day and Figure 7 is a plot of the water levels, see OGE report);

- The OGE report has identified that there is nothing in over two years of hydrochemical borehole monitoring data to suggest that there has been any adverse impact from the quarry operations on the ground water resource.

- The ground water inflow to the quarry is absent or very low.

- Ground water moves within the upper 5 or 6 meters of the ground where small joints, cracks and bedding planes exist. These features are not present to any significant extent greater than 6 meters bgl - the bedrock is very tight below this depth. There are no geological fault lines within the quarry site or immediate locality and there are no karst features within the quarry site, inspection of quarry faces and borehole logs indicates that karst features are unlikely to be encountered as the extraction continues to its proposed extent.

- The final void volume at the end of the life of the quarry will be approximately 3,000,000m^3. The average ground water recharge to the quarry area is 5l/s. On this basis it will take the quarry void about a year to flood back up to the average ground water level prior to the start of the quarrying operation.

- The fully recovered ground water levels in the immediate locality will return to a maximum of between 2m and 5m of the surface. It will fluctuate by a maximum of 4 to 5 m in response to the seasons. Following closure and reinstatement of the quarry site, the quarry extraction area will not overflow during a 1/340 year flood.

- No seepages were observed entering the quarry in late September and early October 2010. The extent of the impact of the quarry operation on the local ground water table is between 500m and 700m of the quarry boundaries. There will be no notable diminution in the quantities of ground water in the local catchment.

5.7 OGE Ltd Restoration Recommendations

The OGE Ltd report has outlined suitable reinstatement options for the site regarding the treatment of the extraction area and areas around the extraction areas. Restoration recommendations include:

- To conform with the Q_{BAR} and 1 in 30 year flood protocols the maximum permissible discharge is 34 l/s i.e. Q_{BAR}. The discharge from Coshla Quarries will not be off-site. All pumped waters will be directed to the settlement pond area, where they will percolate to the groundwater system. The source of all pumped waters will be the quarry sump, i.e. the lowest bench of the quarry.
- The maximum permissible discharge off site is 34 l/s (Q_{BAR}). The estimated 1:30 year storm event will generate 221 l/s (18239 m^3/day). There will be a storage requirement on site of 187 l/s (16157 m^3/d) during a 1:30 year storm event.
- The area of the existing pit is 33,890m^2. The quarry sump will fill up to a depth of approximately 0.48m during a 1:30 year flood event. The quarry sump filled to a datum of 0.95 mOD during the November 2009 flood event.
- The sump was able to accommodate the storm event of November of 2009 which was greater than 1:340 year return period storm event.
- The quarry excavation can continue to the originally outlined extraction area in the planning permission and it will not create any flood risk for the quarry site or the locality.
- The presence of the extraction hole provided significant flood relief to the locality during the November 2009 flood event. The increase in size of the extraction hole will only have a positive effect on this situation.
- Following site closure the floor of the extraction hole shall not be in-filled with soils as the extraction hole will eventually flood back to an a maximum of 2 to 5 meters bgl. The water level will fluctuate according to the seasons and within a maximum of 2 to 5 meters bgl.
- The perimeter soil berms may be maintained, upgraded and planted with site screening vegetation, this will not pose any flood risk or any other hydrological/ hydro-geological risk.
- Safety fences around the extraction hole will not cause any flood risk.
- The areas around the extraction area i.e. the area to the immediate west of the

extraction area can be landscaped with imported soils and grassed and planted. The landscaped soils shall be topographically landscaped to allow any temporary surface water resulting from precipitation to flow towards the extraction hole. Landscaping works which topographically grade towards the quarry extraction areas will ensure that there is no flood risk to surrounding lands.

- The removal of site infrastructure and site hard standings will not cause any flood risk impact.
- The final extraction plans may include for additional benches, battered back walls to increase physical diversity and aid visual restoration.
- Some gravel heaps may be left at the foot of the quarry benches (quarry walls above seasonal water levels) to increase physical diversity and aid visual restoration.
- Some heaps of soils may be tipped onto the quarry bench-tops where appropriate/ possible to encourage plant growth.
- The probability of the November 2009 flood event reoccurring is less than 0.35%.
- Following closure and reinstatement of the quarry site, the quarry extraction area will not overflow during a 1/340 year flood.
- Landscaping details as outlined above will not present any additional flood risk to the surrounding lands should a 1/340 flood event reoccur.
- It is indicated that NVM Ltd will continue monitoring of groundwater quality at the site boreholes.

5.8 Designated Sites

Sites of national importance in the Republic of Ireland are termed proposed Natural Heritage Areas (pNHA's). While the Wildlife (Amendment) Act 2000 has been passed into law.
Special Areas of Conservation (SAC's) are sites of international importance because of the presence of listed habitats or species that are of European importance. Special Protection Areas (SPA's) for Birds are designated based on the presence of internationally significant populations of listed bird species. Legal backing for the protection of candidate SPA's and SAC's in Ireland is provided by the EU Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC; commonly known as the 'Habitats Directive').

There are no sites of international importance overlapping with or in the immediate adjacent environs of the proposed site i.e. candidate Special Areas of Conservation (cSAC) or Special Protection Areas for birds (SPA's). The closest designated site is Galway Bay Complex

located to the south west of the site. The Galway County Council Development Plan 2003-2009 or County Council Development Draft Plan 2009-20015 does not list any area of local/ regional ecological importance in the environs of the site.

According to the NPWS web browser there are no flora or fauna species of conservation interest located within the ten kilometer square grid in which the current quarry site sits.

5.9 Non Designated Sites

There are no non-designated sites of local/ regional ecological importance in the environs of the site.

6. SITE RESTORATION OPTIONS

A review of current literature on quarry restoration and more specifically limestone rock quarry restoration has been carried out. In addition comprehensive and in depth hydrological and hydro-geological assessment has been carried out at the site, the results of these investigations give a factual and scientific description of hydro-geological environment on-site and in the surrounding locality. In addition local groundwater levels have been assessed. Furthermore a Flood Risk Assessment of the site and its surrounding locality has been carried out according to "The Planning System and Flood Risk Management Guidelines for Planning Authorities" – DEHLG & OPW, 2009). These studies have focused on making flood risk assessments, and hydrological/ hydro-geological recommendations for this proposed Restoration Plan for the site. It has been identified that the following restoration options exist for the site at Coshla Quarries:

- Part Biodiversity and part agricultural land (closed to public);
- Biodiversity and nature conservation (closed to public);
- Biodiversity and park or mixed amenity (possibly open to public);
- Commercial amenity only (options include fishing, walking, wall climbing, off road mountain cycling etc);
- Site closure and left to nature.

Following recommendations indicated as part of hydro-geological and flood risk assessments, the option chosen is to implement restoration of the site to 'part biodiversity and part agricultural land (closed to public)'. In addition it should be noted that from this restoration option that all other above listed options can be achieved in the future if so desired.

7. PROPOSED HABITATS

7.1 Habitats

Prior to development of the quarry the site was improved agricultural grassland, a small area of outcropping rock was known to exist at the centre of the site and sparse hedgerows existed around the site perimeter. There were no habitats of any ecological interest identified on-site or proximal to the site prior to quarry development. There was no archeology of any interest identified on-site or proximal to the site prior to quarry development. According with the habitat codes established in *A Guide to Habitats in Ireland* published by the Heritage Council (2000) the site was classified as improved agricultural grasslands GA1 prior to development. The proposed development site is now classified as ED4 (Active Quarries and Mines) and BL3 (Artificial Surfaces). The lands outside the existing quarry are improved grassland for agricultural proposes (GA1) improved agricultural grassland. Stone walls (BL1) in association with hedgerows (WL1) also exits as field boundaries in the surrounding lands.

The site floor can be currently identified as an Artificial Surface (BL3) of crushed rock and ED4 (Active Quarries and Mines). The proposed reinstatement plan will work to encourage the development of some if not all of the following habitats on-site. They will exist as a mosaic with some habitats existing over greater areas. The site will be left to develop in a natural ecological succession manner, some habitat classifications will be succeeded by others and become overgrown, some of the listed habitat classifications currently exist on site, others will be created as part of landscaping works towards and at the end of the quarry working life:

List of proposed and potential habitats on-site during following phase I, II, III, and IV restoration works and subsequent closure of the quarry:

- Amenity grassland (improved) (GA2)
- Improved agricultural grassland (GA1)
- Scrub (WS1)
- Immature woodland (WS2)
- Hedgerows (WL1)
- Treelines (WL2)
- Exposed Calcareous rock (ER2)
- Calcareous scree and loose rock (ER4)
- Artificial (calcareous) lakes and ponds (FL8)
- Earth banks (BL2)
- Exposed gravels and till (ED1)
- Re-colonising bare ground (ED3)

7.2 Potential long term reinstatement habitats - Habitat descriptions

Descriptions of the potential restorative habitats and proposed habitats including habitat vegetation are given below. The habitats are described as how they may eventually appear on-site following some years for the vegetation to develop. The general areas of where the specific habitats may occur or be prompted are also given. A map illustrating the proposed long term reinstatement layout of the site is submitted with relevant cross sections and elevations. In addition some illustrative plates of limestone quarries which have either been left to nature or undergone forms of reinstatement management are provided, these plates help the reader to visualise the potential both short term (1-5 years) and long term (5-15 years) of limestone quarry reinstatement. We have identified areas for specific planting and vegetation promotion at the Coshla site. It is expected that several areas at the site will resemble places shown in the photographs following a few years growth. Landscaping of several parts of the site will had immediate positive visual impacts. Technical work outlined below will be carried out during the operational phase and the final phase of quarry extraction to ensure these situations can be achieved as far as practically possible. The potential habitats proposed for the site are as follows:

7.2.1 Amenity Grassland (GA2)

Amenity grassland is typically associated with lawns and other managed grassland areas in gardens and parks. This classification may be suitable to exist as small manicured gardened areas at the areas around the site entrance.

7.2.2 Improved Agricultural Grassland (GA1)

This category is used for intensively managed or highly modified agricultural grassland that has been reseeded and/ or regularly fertilised, and is now grazed. It includes regularly-reseeded monoculture grasslands and rye-grass leys that are planted as part of an arable rotation. Areas of the site outside of the extraction area may initially be restored to GA1 and GA2, however eventual ecological succession (if left unmanaged) may change these areas into more diverse habitat such as semi natural calcareous grassland. The quarry site was GA1 (improved agricultural grassland) prior to development and the entire surrounding habitat is currently GA1. The option is to reinstate the entire quarry (outside of the extraction area and surrounding berms) to GA1; however this provides little biodiversity value; therefore other vegetation will also be planted and promoted where possible and appropriate at the site. Native Irish grasses include Dog's Tail, *Cynosurus cristatus*, and Yorkshire Fog, *Holcus lanatus,* these should be used to a greater percentage in the reseeding mix. Furthermore it is pointed out that grass seed mixes are available with wildflower mixes, they are 100% Native Irish wildflower seed mixtures, (Provenance: Irish Wild Sourced and Irish Farm Grown 100%

Native Wild Flora). These mixes provide greater biodiversity and they are given as part of technical details in the management instructions of this Restoration Management Plan.

The category dry calcareous grassland (GS1) is used for unimproved or semi-improved dry grassland that may be either calcareous or neutral, but not acid. It is associated with low intensity agriculture and typically occurs on free-draining mineral soils of various depths. This habitat may develop on areas outside the extraction area where the soils are suitable. It should be noted that it is hard to source a seed source to promote this habitat and in addition the imported soils used for landscaping may not be suitable however patches of this grassland may develop around the fringes of landscaped areas. However it should also be pointed out that the long term sustainability of calcareous grassland is subject to its proximity to similar habitat patches. It may not be possible to recreate or promote this habitat long term at the quarry site however the habitat type is included here for consideration in the restoration goals.

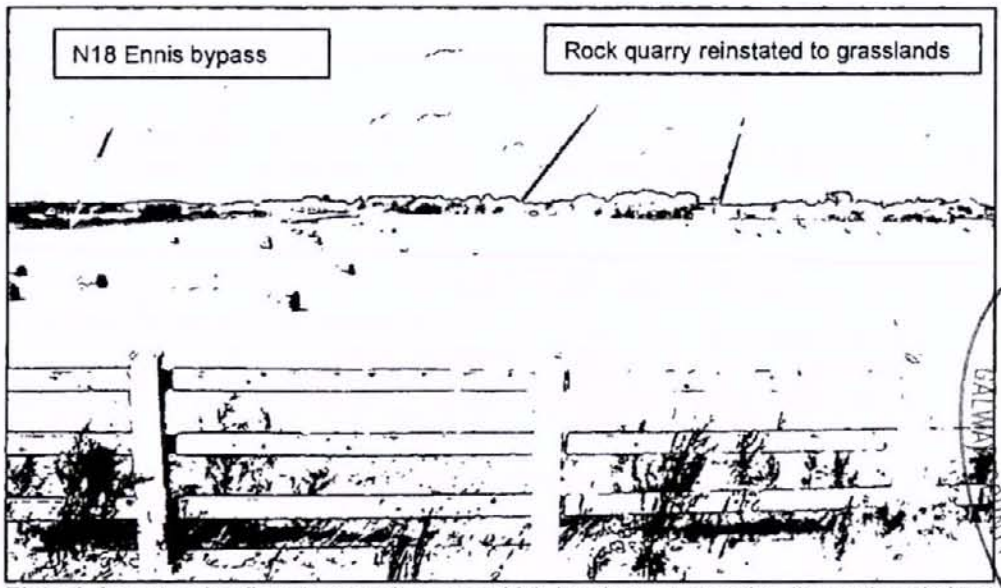

Plate 1 An extensive limestone rock quarry which has been restored to its previous habitat type, improved agricultural grassland (GA1). This quarry site is adjacent the Killow intersection on the Ennis bypass N18. The majority of perimeter mature trees where retained as part of this project. INIS Environmental Consultants Ltd was responsible for this restoration.

7.2.3 Scrub (WS1)

This broad category includes areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles. The canopy height is generally less than 5 m, or 4 m. Scrub is expected to develop as patches some years following closure of the site. Scrub frequently develops as a precursor to woodland and is often found in inaccessible locations, many parts of the site will suit the development of WS1 and this habitat provides good cover for fauna while encouraging other vegetation to develop by providing cover and wind shelter. In the

absence of grazing and mowing on-site the scrub can expand to replace grassland areas. Trees can be included as components of scrub but their growth will be controlled by soil quality, their growth will be stunted as a result of poor soils. Scrub can eventually become dense and impenetrable, and it can occur successfully on areas of dry soils, like that which currently exists onsite outside of the extraction area, soil may be incorporated into parts of the extraction area e.g. face benches and patches of the floor to encourage growth. Common scrub components include spinose plants such as Hawthorn *(Crataegus monogyna)*, Blackthorn *(Prunus spinosa)*, Juniper *(Juniperus communis)*, Gorse *(Ulex europaeus)*, Bramble (*Rubus fruticosus* agg.) and erect or scrambling roses (*Rosa* spp.), and small birches (*Betula* spp.), willows (*Salix* spp.), and stunted Hazel *(Corylus avellana)*.

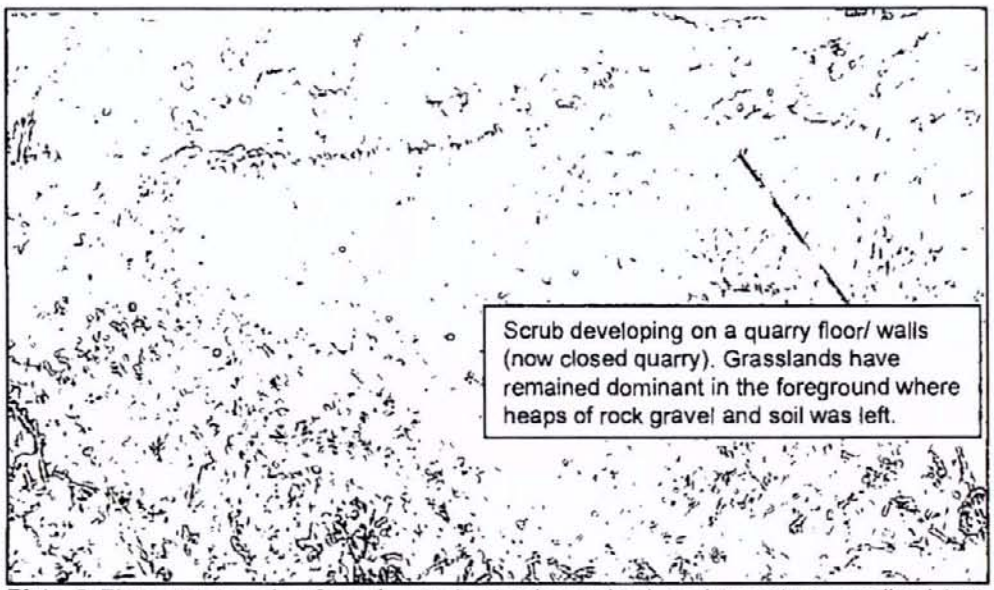

Plate 2 Elements/ mosaic of scrub, semi-natural grassland, and immature woodland type habitats are present in this limestone quarry which has been closed and left to biodiversity.

7.2.4 Immature Woodland (WS2)

Immature woodland includes areas that are dominated by young or sapling trees that have not yet reached the threshold heights (5m, or 4m). There is the possibility of this habitat developing within the site in the long term, however it is considered that habitat conforming to the scrub - WS1 classification is more likely to develop and be come dominant on site. Immature woodland will only develop following long term growth at the site (6-15 years). Immature woodland will be pre-planted as part of screen works around the southern boundary.

Plate 3 Elements/ mosaic of scrub, semi-natural grassland, and immature woodland type habitats are present in this limestone quarry which has been closed and left to nature. Some immature woodland is developing amongst the scrub and around the quarry fringes.

7.2.5 Earth Banks (BL2)

Earth banks are presently in place around virtually all lengths of the quarry site perimeter with the exception of entrances and exit locations. The soil berms were developed from topsoil's stripped from within the site prior to extraction works. The soil berms are generally less than 5m high and 7m wide. These soil berms can be easily increased in size if necessary. This restoration plan has proposed for the development of planting of shrubs and hedgerows in conjunction with tree lines along these berms for visual screening of the site. The proposed specifications for the berms are indicated in the drawings submitted with this report.

7.2.6 Hedgerows (WL1)

Linear strips of shrubs and spinoise plants (to promotes initial soil stabilisation), with planted trees, are proposed to form the quarry boundaries. This vegetation to be planted will occur on raised banks of earth that are derived from the excavation of on-site soils and imported soils used in the quarry perimeter soil berms. The dimensions of hedgerows will vary due to natural growth, however maintenance will be applied (during the working life of the quarry) to promote growth, the hedges can be expected to be generally less than 5m high and 4m wide. Technical specifications are given in Section 8.4 of this report.

7.2.7 Tree-Lines (WL2)

A tree-line is a narrow row or single line of trees that is greater than 5m in height and typically occurs along field or property boundaries. Tree-lines will be planted in conjunction with

hedgerows during the operational phase along the quarry soil berm boundaries to provide visual screening. The extent of this visual screening is illustrated in the side elevation viewpoint drawing submitted with this Restoration Plan. The tree-lines planted on the berms will consist of two or more stepped tree-lines to create a more natural look. Technical specifications are given in Section 8.4 of this report.

7.2.8 Exposed Calcareous Rock (ER2)

This category is used for all natural and artificial exposures of calcareous bedrock and loose rock, and any other exposures of basic rock (Fossitt, 2000); the quarry face and many parts of the quarry floor and surrounding areas will conform to this habitat classification both presently and following some years of restoration. Following some years of closure we will expect some patchy cover of vegetation, in places attempts will be made to concentrate gravel heaps (similar to scree) and deposit soils at some locations e.g. on quarry face benches. Exposed calcareous rock may support small pockets of species-rich calcareous grassland, heath or scrub vegetation. Typical natural colonisers include ferns (particularly *Cystopteris fragilis* and *Asplenium* spp.), and woodland plants such as Honeysuckle *(Lonicera periclymenum)*, Ivy *(Hedera helix)* and Sanicle *(Sanicula europaea)*. Small pockets of dry calcareous grassland, heath or scrub vegetation are common in areas where there is sufficient soil cover (Fossitt, 2000). This habitat has *Links with Annex I of the Habitats Directive,* Exposed calcareous rock corresponds to two annexed habitats, 'calcareous rocky slopes with chasmophytic vegetation (8210)' and '*limestone pavements (8240)'. The latter is a priority habitat.

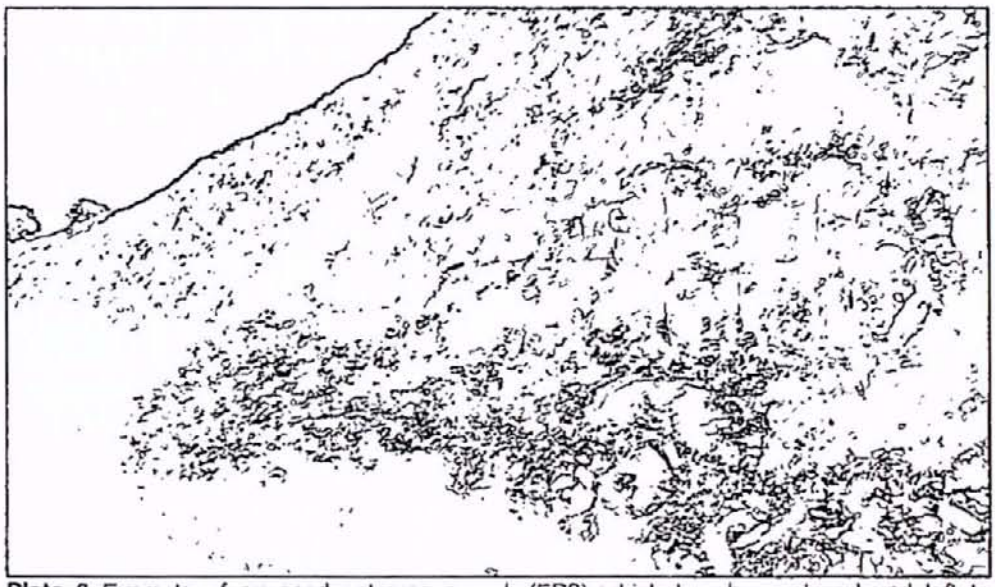

Plate 3 Example of exposed calcareous rock (ER2) which has been closed and left to biodiversity. This is what a quarry face and bench will initially look like 1 year after site closure/ reinstatement.

Plate 4 This now closed quarry is an example of exposed calcareous rock (ER2) which has been left to nature. This is an example of what quarry floors, faces and benches will initially look like >8 years after reinstatement. A reinstatement plan such as this can expedite the recovery of the site and improve the immediate visual quality of the site.

Plate 5 Exposed calcareous rock (ER2) which has been left to nature. This is an example of what quarry faces and benches will initially look like >8 years after reinstatement. A reinstatement plan which includes final extraction faces which include benches can expedite the recovery of the site and improve the immediate visual quality of the site.

7.2.9 Exposed Gravels and Till (ED1) & Re-colonising Bare Ground (ED3)

This category covers disturbed grounds such as that at quarries or similar sites and includes natural or artificial exposures of unconsolidated mixed or course sediment such as gravels, sands and soils. It should be noted that while operational, the quarry should be classified under ED4 active mines and quarries. This habitat will exist within the extraction area and as a mosaic with other habitat classifications throughout parts of the site.

Plate 6 Exposed calcareous rock (ER2) of a now closed limestone quarry floor which was not top-soiled but instead has been left to nature

Plate 7 Looking south east, the quarry (lowest bench) at Coshla 2010 (pictured above has the potential for reinstatement to habitats as described above. This plan involves for the final extraction works to include for 1-2 face benches on two if not all of the quarry walls to allow for vegetation niches to develop within the extraction areas. Scree slopes will also be created with gravel heaps within the extraction hole.

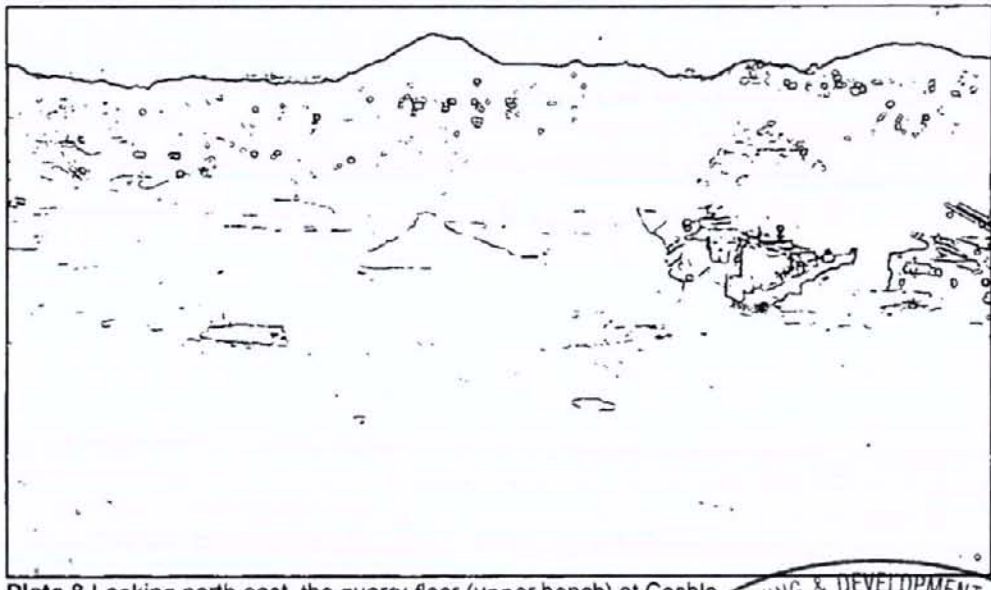

Plate 8 Looking north east, the quarry floor (upper bench) at Coshla.

7.2.10 Buildings and Artificial Surfaces (BL3)

Many parts of the present operation at Coshla can be classified under buildings and artificial surfaces (BL3). They include the infrastructure such as the wheel wash, maintenance shed, car park, site office, weighbridge, oil interceptors, silt settlement tanks, concrete plant, concrete plant wash out area and the asphalt plant infrastructure. All of these features will be decommissioned as far as practically possible as part of the final reinstatement phase. The areas will be landscaped and vegetated.

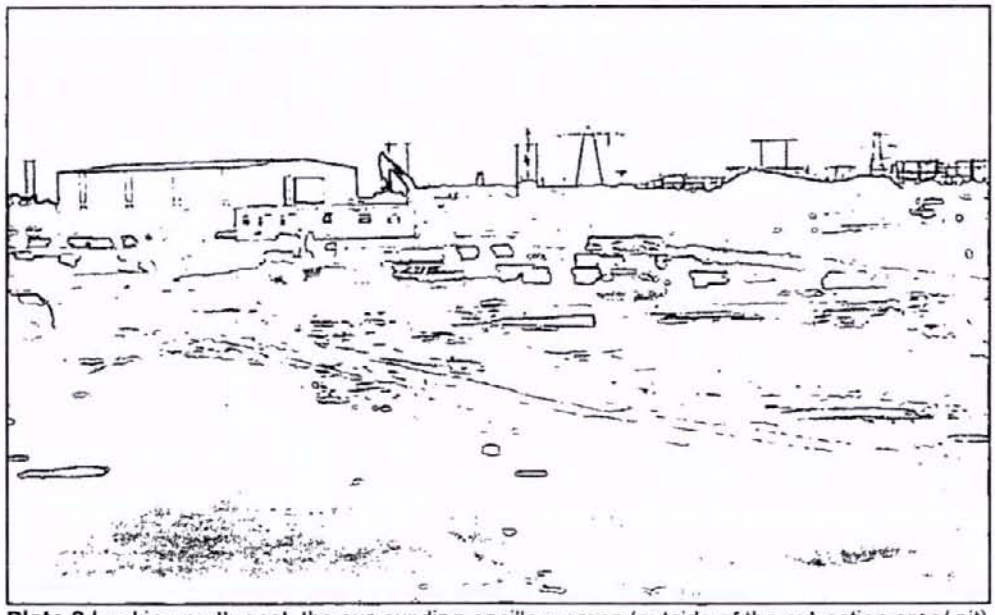

Plate 9 Looking north east, the surrounding ancillary areas (outside of the extraction area/ pit) at Coshla including the maintenance shed, weighbridge and site office.

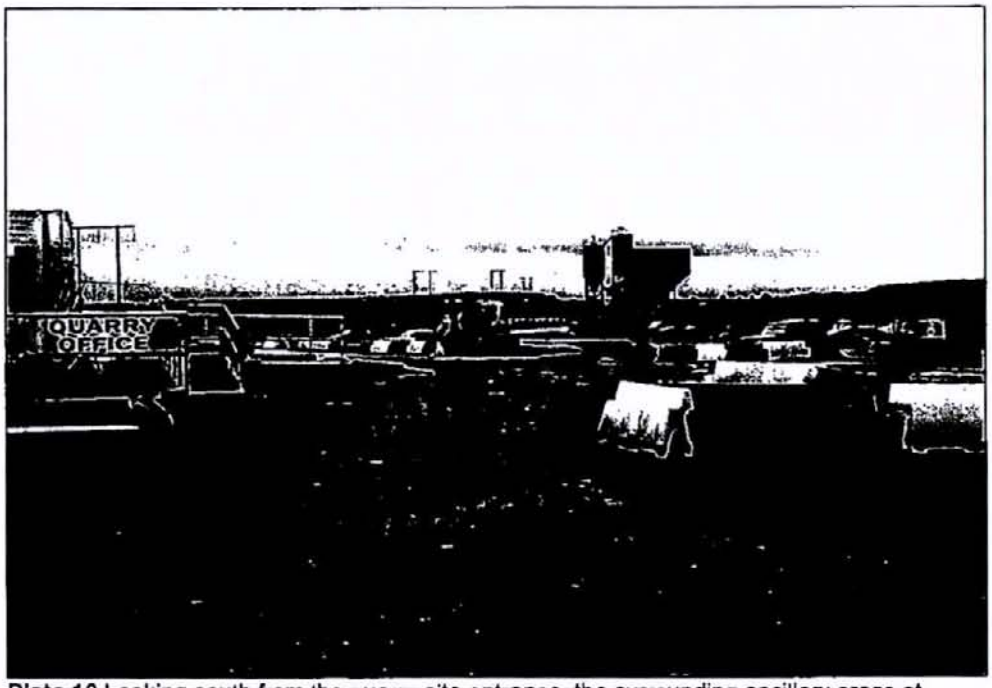

Plate 10 Looking south from the quarry site entrance, the surrounding ancillary areas at Coshla including the concrete plant, weighbridge and site office are visible.

7.2.11 Artificial (calcareous) Lakes and Ponds (FL8)

This category should be used for artificial or ornamental bodies of standing water. Flooded quarries, tailings ponds and water treatment plants (with open water) are included in this category. The OGE Ltd report has outlined that the quarry extraction hole will fill up and form a long term lake, the classification FL8 covers this scenario.

8. RESTORATION MANAGEMENT GUIDANCE

The restoration of pits and quarries poses a number of challenges as there is often limited overburden and topsoil left to contribute to the establishment of vegetation. This is especially true in the case of rock quarries; the remaining rock faces and rubble left on the quarry floor are exposed and development of vegetation will be sparse and stunted. In addition newer pits and quarries pose an added challenge as modern extraction processes have become increasingly efficient, leaving less rubble and overall less physical diversity, so restoration may benefit from reintroducing a range of landforms (Hough, Woodland, Naylor, Dance Ltd, 1995). This range of landforms can be created by management of the final phases of extraction i.e. blasting can be directed to form quarry face benches, excess gravel can be located at the quarry face to mimic scree slopes and additional landscaping of extraction faces can be completed with overburden (soil) placement.

Despite the constraints, there are many examples of former aggregate sites in Ireland which have already demonstrated that it is possible to vegetate and visually reinstate limestone rock quarries both in the short and long term. Some illustrative plates which illustrate short and long term reinstatement have been given above, additional plates are provided in Appendix I. It should also be noted that the problems associated with re-soiling at Coshla Quarry can be overcome by the importation of excess soils extracted from outside construction sites. This will be done in accordance with the OGE Hydrology Ltd Flood Risk Assessment recommendations and under permit from Galway County Council.

The majority of on-site habitat and quarry restoration at Coshla will make use of locally indigenous native plants or seed mixes (unless directed otherwise by ABP). Using non-native seed mixes is generally discouraged except where there is a high potential for erosion and the plant species are not persistent (e.g. Annual Ryegrass). Non-native seed mixes are typically made up of a 'nursery' crop that is highly effective in 'greening up' sites but can also interfere with the successful establishment of native species (Beamer, 2007). The seed mixes proposed as part of this plan do not require any nursery crop.

The information presented overleaf is not intended to be comprehensive/ exhaustive it is intended to provide the necessary guidelines and management considerations to assist in reinstatement of the site.

8.1 Strategies for Site Decommissioning

- An extensive environmental exit audit will be conducted to include:
  -Implementation of the details of the proposed Restoration Phases as outlined below (or with any amended or new restoration proposals added by Galway County Council and/ or An Bord Pleanala)
  Noise generation (ambient/ occupational/ health and safety);
  -Current and imminent environmental legislative obligations;
  -Plant dismantling;
  -Built surfaces dismantling;
  -Residuals management;
  -Consideration of details of any exit plans for the adjacent properties;
  -Implementation checklist for the restoration phases (as outlined below) and their details.

- All machinery and buildings will be decommissioned as per standard procedures;
- All plant will be de-constructed and removed from the site;
- All concrete structures associated with securing the plant in place will be demolished and removed;
- All infrastructures such as oil interceptors etc will be removed;
- A report outlining initial decommissioning of plant will be issued to the Planning Authority;
- Final reinstatement of the quarry location and extraction area will be reinstated as part of the surrounding Coshla Quarry Restoration Management Plan, as outlined here;
- Similar sites in the UK have been reinstated to a diverse set of habitat niches which encourage biodiversity in the locality. A plan for this is outlined in this document;
- A report outlining final reinstatement of the plant and the surrounding quarry area will be issued to the Planning Authority (including environmental exit audit and restoration plan implementation audit).
- Further to agreement with the Local Authority ongoing environmental monitoring will be extended in order to ensure that no residuals exist on site.

8.2 Use of Native Species for Site Planting

Central to the core objective of this Restoration Management Plan is the promotion of the use of native plants and seed from indigenous seed sources within the site restorative landscape treatments. The Heritage Council, National Parks and Wildlife Service and NRA acknowledge that the use of native species can make a significant and important contribution to the conservation of biodiversity whilst retaining and improving the regional identity, the distinctive

landscape character and the cultural significance of the Irish landscape. Gasses to be planted on-site will be mixed with native wildflower mixes to enhance biodiversity. The grass seed mixes and wildflower mixes are provided by Designed by Nature (DBN) - Wildflowers.ie; they provide grass seed and wildflower mixes which compliment each other and do not require nursery crops. In addition several grass seed/ wildflower mix options are provided to suit each specific soil type which may developed on-site i.e. peaty soils or wet limey or dry limey soils etc. Planting stock that complies with the sourcing conditions of the Native Woodland Scheme will be considered for landscape treatments at the Coshla site. The seed deliveries will be accompanied by an approved Provenance Declaration.

This Restoration Management Plan promotes the use of native species and indigenous plant materials that meet the criteria of the Native Woodland Scheme so as to:

- Comply with international and national landscape policies (e.g. Biodiversity plan, Biodiversity plan review, native woodland scheme, landscape character assessment in Ireland etc) which emphasise the management of landscape quality;
- Contribute to national commitments on nature conservation and promotion of biological diversity, by providing a positive step towards establishing native habitats and reducing the planting and dispersion of non-native plants;
- Restore or compensate for loss of habitat and diversity;
- Complement the establishment of self-sustainable treatments as the native species which will be chosen for the various parts of the site will be to some extent "pre-adapted" to site conditions, therefore it is hoped that the plants will naturally thrive.

8.3 The Restoration Phases for the Quarry

8.3.1 The Restoration of the Quarry Is Divided into the Following Phases

This section of the Restoration Management Plan report outlines the work to be carried out in a phased programme over the operational life of the quarry, towards the end of the operational life and during wind down operations to ensure that the restoration of the quarry lands will be implemented in accordance with the proposed landscaping and habitat creation goals/ targets recommended in this report. The restoration of the quarry is divided into four phases:

- **Phase I** – Formations of embankments during rock extraction (quarry operational life) to provide screening of the works from the surrounding environment. Restoration/ landscaping of areas outside of extraction area with in-situ and imported soils - waste facility permits/ certificates of registration may be required and will be applied for as directed by Galway County Council. Quarry perimeter landscaping and berm formation and planting to provide visual screening of the operating quarry and long term screening of the quarry from the proximal N6 motorway to the south and private houses to north west, north and north east. Phase I works will be carried out during the commercial operating phase of the quarry. All formation of embankments/ perimeter berms and landscaping of areas outside the extraction area will be carried out according to recommendations provided in the OGE Hydrogeology Ltd., Flood Risk Assessment and Hydrogeology Assessment of the Coshla Quarry site. Specific management details for the Phase I works are given in Section 8.4 of this report

- **Phase II** – Formation of quarry face benches towards the end of the extraction phase. This practice is recommended in restoration manuals reviewed as part of the preparation of this report. The pertinent restoration manuals are listed above in Section 4 (desktop literature review). The formation of landscape features such as quarry face benches and gravel scree slopes. This provides more long term habitat niches for both flora and fauna. It also allows vegetation to colonise the site and give a more natural appearance in the long term. Specific management details for the Phase II works are given in Section 8.5 of this report

- **Phase III** – This phase includes for final works in and around the extraction pit and restoration of areas below groundwater level. This phase will be implemented as part of or just prior to the final extraction works. These areas will be demarcated to indicate the extent to which seasonal water levels can fluctuate within the quarry extraction hole. Some quarry benches tops may exist between the seasonal high and low water levels. These benches may still be allowed a covering of soils to enable

aquatic and semi aquatic plants to gain a foothold. Any scree slope/ gravel heaps and or battering back of the quarry benches should be carried out during this phase.

- **Phase IV** – Final restoration will include the incorporation of safety fencing around the extraction faces, final landscaping and vegetation planting of areas outside of and within extraction area, buildings and infrastructure decommissioning, site house keeping (tidying) additional formation of landscape features such as gravel scree slopes. Specific management details for the Phase IV works are given in Section 8.7 of this report

The Appendix IV drawings indicate the proposals for berm improvements, soil importation and landscaping, including top, side and land-cover planting at the quarry, the final extraction plans and details of final quarry face benching etc during the final extraction process are also given. Detailed drawings including species planting and proposed final land-cover are also given as part of the proposed side slope rehabilitation after the quarry process is complete.

8.4 Phase I – Formation of embankments and landscaping

This Phase may now be commenced on-site following the finding and recommendations of OGE Hydrogeology Ltd., Flood Risk Assessment and Hydrogeology Assessment of the Coshla Quarry site. Landscaping details at the areas outside of the extraction hole are proposed and outlined in the restoration plan drawings (see Appendix IV). Application for 'Certificates of Registration' and/ or 'Waste Facility Permits' will be applied for as necessary. Consultation regarding this will be instigated with Galway County Council. In addition the formation and planting of embankments will be carried out during the commercial rock extraction phase of the quarry to provide screening of the quarry works from the surrounding environment. There are six seed planting mixes proposed for use within the quarry site. The seed mixes are chosen to conform to native woodland planting schemes, NPWS biodiversity guidance documents and to suit the specific characteristics which are and will be present within the site. The site restoration plan drawing given in Appendix IV indicates the locations for planting mixes to be applied. Further texts below outlines more specific guidance for planting at specific areas of the site e.g. the most suitable seed mix for the relatively small areas of quarry benches which may be seasonally flooded is outlined. In addition three grassland and wildflower meadow mixes are provided to accommodate the potential for different soil types being used for landscaping at the site.

The different proposed seed mixes are colour coordinated or similarly indicated on the restoration plan drawings, the proposed location of the specific planting mixes on-site are also indicated on the restoration plan drawings. The different proposed seed mixes and the broadly corresponding Fossitt classification codes are as follows (Further detailed specifications regarding all aspects of the seed mixes are given in Appendix III):

PROPOSED SEEO MIXES – corresponding Fossitt classification code in brackets

Specific seed mix and plant mix details and specific planting management information available in Appendix II and III.

(1). Woodland Planting Mix (WS2/ WL2):

(2). Scrub Planting Mix (WS1):

(3). Grassland & Wildflower Planting Mixes (GA1 & GS1):

(4). Exposed Rock Wildflower Planting Mix (ER2):

(5). Seasonally Flooded Exposed Rock Wildflower Planting Mix (ER2 & FL8):

(6). Deep Water Planting Mix (FL8):

Restoration Plan Planting Mix Summary details:

(1). Woodland Planting Mix (WS2/ WL2):

Hazel,
Birch (NWS)
Downy Birch (NWS)
Holly (NWS)
Goat Willows (NWS)
Scots pine (NWS)
Ash (NWS)
Alder (NWS)
Whitethorn
Blackthorn (NWS)
Gorse
Dog rose

(2). Scrub Planting Mix (WS1):

Hawthorn,
Blackthorn,
Bramble,
Willows,

Mixed with:
Native Origin Irish Wildflower Seed Mix, product Name: Ecotype Range - Hedgerow Wild Flower Mixture (Product Code: EC04). The Scrub Planting Mix will be used on the sides of the site perimeter soil berms and at selected location throughout the site as indicated on the restoration plan drawing.

(3). Grassland & Wildflower Mixes (GA1 & GS1):

Native Origin Irish Wildflower and Grass Seed Mix, Three options for three different soil types are provided to accommodate each potential soil type which may be imported, they are:

MM05 - Wildflower and Grasses Seed mixture MM05 for Soil with high peat content;
MM09 - Wildflower and Grasses Seed mixture for Dry Limy Soil (alkaline, pH >7);
MM08 - Wildflower and Grasses Seed mixture for Moist Limy Soil (alkaline, pH >7).

(4). Exposed Rock Wildflower Mix (ER2):

Native Origin Irish Wildflower Seed Mix, Product Name: MM09 Wild Flora for Dry Limy Soil.

(5). Seasonally Flooded Exposed Rock Wildflower Mix (ER2 & FL8):

Seasonally flooded quarry bench Mix: Native Origin Irish Wildflower Seed Mix. Product Name: EC05 Wetland Wild Flora (Seasonally Flooded).

(6). Deep Water Plant Mix (FL8):

Pondweed, White Water Lily, Yellow Water Lily.

8.4.1 Embankment Construction

Several lengths of soil embankment berm presently exist along the perimeter of the quarry site. It is proposed to construct soil embankment berms to the remaining areas that are without embankment berms around the perimeter of the site and/ or increase in size the existing berms; proposed berm specifications are provided in the attached drawings. Additional screening details are also proposed with these works. This berm shall create an immediate screening effect to any works carried out within the quarry, and shall also further reduce any potential noise and dust levels proximal to the site. All materials required for the construction of this berm shall be sourced within the cartilage of the site, using the organic soil and overburden stripped from the site as part of the quarry operation. Significant stockpiles of soil exist within the eastern section of the site. If additional soil is needed it will be brought into the site as per waste Permit Facility Guidelines and the necessary Facility Permits will be applied for.

The suggested berm width at base is 18 metres and the width at top is approximately 5 metres. Hedgerows and tree-lines will be planted along the berms. Several sections of the berms provide the opportunity to give extra visual screening detail, especially along the southern perimeter of the site proximal to the N6 road. Here sections of the berm will have additional tree-lines planted.

The proposed process for the construction of this berm is as follows;

1. Strip all topsoil and store in spoil heaps adjacent to the embankment locations. Ensure that topsoil stripping operations are only carried out during dry weather to prevent undue compaction and to retain soil structure.
2. Excavated material shall be placed around the perimeter of the site and can be formed into the finished embankments. The fill material should be compacted as construction proceeds using the tracked earthmoving equipment.

3. On completion of the mound construction, top-soiling operations shall commence. An even cover of 200mm of topsoil shall be spread across the top and sides of the berm, this depth shall ensure an excellent root zone for subsequent planting works but shall reduce the risk of this material slipping if greater depths were applied. As works proceed the fitted soil will be tightened with the tracks of the fitting equipment. Ensure that topsoil fitting operations are only carried out during dry weather to prevent undue compaction and to retain soil structure.
4. Seeding shall be carried out according to seed specification notes provided in Appendix II and III. The seed mix for the side of the berms is the 'Scrub Planting Mix' and the seed mix of the top of the berms is the 'Woodland Planting Mix', as outlined above in Sections 8.4.3, 8.4.4 and in Appendix II and III.

8.4.2 Soil Berm (site perimeter) Planting Works

All planting works will be carried out during the dormant season, i.e. November to March. Prior to the commencement of planting works, the planting shall be split into two groups; the top of the embankment and the sides.

8.4.3 Berm Top Planting – Proposed 'Woodland Planting Mix'

As per the detail of the Woodland Planting Mix as outlined below and in Appendix III, this area will be planted with a mixed matrix of hardwoods and suitable smaller or under-storey species. A feature of this area shall be the inclusion within the planting mix of 50% larger trees - *fraxinus excelsior* (Ash) – this will create an immediate visual impression in keeping with the surrounding indigenous landscape*. A general guide to tree and shrub species for Irish conditions is given in Appendix II. The guides include information on plant growth heights and optimum planting characteristics. The berm top planting mix is classified as the 'Woodland Planting Mix' as indicated on the attached restoration plan drawing Appendix IV. This classification broadly corresponds to the Fossitt habitat classification of WS2 - Immature woodland when present in an area >4 meters wide and corresponding to Fossitt classification WL2 when <4 meters wide i.e. treelines. The same planting mix will also be applied to selected areas of the site as indicated on the restoration plan drawing (see Appendix IV) albeit in a less linear design.

* If required the planning authority or ABP may request a non-indigenous species such as Poplar (*Populus nigra*) which are commonly used as a screening tree.

The full proposed **Woodland Planting Mix** (broadly corresponding to Fossitt classifications WS2/ WL2) is as follows:

Variety	Common Name	% of Mix	Size in cm
Corylus avellana	Hazel (NWS)	10%	
Betula pendula	Birch (NWS)	10%	60/90
Betula Alba	Downy Birch (NWS)	10%	
Ilex aquifolium	Holly (NWS)	5%	
Salix Caprea	Goat Willows (NWS)	10%	
Pinus sylvestris	Scots pine (NWS)	10%	
Fraxinus excelsior	Ash (NWS)	10%	150/180
Alnus glutinosa	Alder (NWS)	10%	60/90
Crataegus monogyna	Whitethorn	10%	60/90
Prunus spinosa	Blackthorn (NWS)	5%	60/90
Ulex Europaeus	Gorse	5%	
Rosa Canina	Dog Rose	5%	

Trees are planted at 1-metre spacing's. **NWS** = National Woodland Scheme. Tree species, with the exception of the *Fraxinus*, shall be planted in groups of 3 on a random basis. The *Fraxinus* shall be planted in staggered rows along the embankment to create an informal screening effect. The larger *Fraxinus* shall be staked and tied as per the attached specification. An Teagasc 'General Guide to Tree Species for Irish Farm Conditions' and Native Woodland Scheme tree and shrub specifications and planting guidance is included in Appendix II to provide further planting guidance.

8.4.4 Berm Side Planting – Proposed 'Scrub Planting Mix'

On both sides of the embankment there shall be planting with a mixed matrix of hardwoods and understory planting to stabilise and screen the embankment; Hazel, because of its rooting structure, is particularly effective in relation to the stabilisation of the embankment soils. An Teagasc hedgerow specification and planting guidance is given in Appendix II. Additional wildflower hedgerow (semi-shade) seed mixes are also given below in Sub-Section 8.4.4.1 as outlined by seed specialists 'Design by Nature' (Wildflowers.ie.). This seed mix can be mixed with the Scrub Planting Mix. These may be most suitable at amenity grassland areas and berms at the site entrance. The berm side planting mix is classified as the 'Scrub Planting Mix'. The restoration plan drawing indicates the proposal for planting on-site (see Appendix IV. This classification broadly corresponds to the Fossitt habitat classification of WS1 - Scrub. The planting mix is a combination of the DBN Hedgerow Wild Flower Mixture and the An Teagasc hedgerow planting mix. The same planting mix will also be applied to selected areas of the site as indicated on the restoration plan drawing albeit in a less linear design.

8.4.4.1 Native Origin Irish Wildflower Seed Mixtures for side berm

Product Code: EC04

Product Name: Ecotype Range -Hedgerow Wild Flower Mixture.

A hedgerow mixture that requires light shade and can have additional bluebell seed added if sowing this mixture in deep shade under overhanging trees or shaded banks.

EC04 Species list:

Birdsfoot trefoil	Hedge Garlic Mustard	Red Campion
Black Meddick	Hemp Agrimony	Ribwort Plantain
Burdock	Hoary Plantain	Sorrel
Bluebell	Cow-Parsley	St Johnswort
Corn Chamomile*	Lesser Knapweed	Teasel
Corn Marigold	Scented Mayweed	Upright Hedge Parsley
Corn Poppy	Meadowsweet	Wild Angelica
Corncockle*	Mullein	Wild Carrot
Cornflower*	Ox-eye Daisy	Wood Avens
Cowslip	Purple Loosestrife	Sweet Violet
Devils Bit Scabious	Primrose	Dog Violet
Foxglove	Ragged Robin	

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or whose habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

Design Notes:

Can be sown with grasses, but is unnecessary. This mixture will not require a nurse crop, as it contains annuals. EC04 if sown in any light or semi shade tolerates moist or dry conditions. While the mixture will grow in full sun it will perform best when there is some shade for part of the day. This seed mixture will provide many species that are colourful in late spring. In dry areas under trees it will produce about 8 final species.

8.4.5 Landscaping of Areas Outside of Extraction Hole

The OGE Hydrogeology Ltd., Flood Risk Assessment and Hydrogeology Assessment of the Coshla Quarry site have both indicated that importation of soils and subsequent landscaping works at the areas outside of the excavation hole will have no negative affects on the hydrology, hydrogeology and/ or the flood risk scenarios at the general locality. Stockpiling and subsequent landscaping of imported soils outside of the excavation hole regardless of height or topographical form will pose no negative impact to any potential flooding in the area. It has been stated by the OGE Hydrogeology Ltd., Flood Risk Assessment and Hydrogeology Assessment that the Carnmore area is prone to flood events during seasonal excessive of rainfall, and that the quarry excavation hole provided mitigation and ameliorated flooding in the locality due to it ability to provide a retention area for flood waters during the November 2009 flood. This is regardless of pumping or any other activity at the quarry. It is therefore clear that the presence of the quarry hole provides a positive impact on the area in terms of flood relief. Without the retention area of the quarry hole then flooding in the locality would be extended in its extent, depth and duration. Any landscaping activities at the quarry will not affect this situation. It is proposed to allow for increased finished ground levels around the quarry which will tie in surrounding lands or surrounding site perimeter soil berms (or as directed proposed by Galway County Council and/ or An Bord Pleanala) The landscaped levels will provide a slope towards the quarry excavation hole. This will ensure that any rainwater/ surface water which does not percolate to groundwater which flow to the excavation hole. Drainage paths within the landscaped areas will be provided to channel and discharge water in controllable routes, two or possibly three catchment areas may be landscaped. The landscaped areas will be seeded and grassed with a native Irish wildflower and grass seed mix sourced for Wildflowers.ie. Several wildflower and grass seed mixes are available according to the soil type and other characteristics. The most suitable mixes will be applied to the relevant areas. The pertinent options are provided below, areas of trees and scrub vegetation are also being proposed. The landscaped areas may extend to the heights of the surrounding berms and will decrease in height within the site towards the excavation hole. Additional grass and clover recommended list varieties for Ireland (Department of Agriculture, Food & Fisheries, 2010) are given in Appendix II. Three options of grass and wildflower seed mixes are given below in Sections 8.4.5.1 t 8.4.5.3, they provide a suitable seed option for each possible soil type which may be imported into the site. Further specifications regarding all aspects of the seed mixes are given in Appendix III. Proposed topographical/ landscaped in-fill will not exceed 1m above quarry ground levels or surrounding agricultural land levels.

8.4.5.1 MM05 Wildflower and Grasses Seed mixture - Soil with high peat content

Product Code: MM05.
Product Name: Wild Flower Mixture Soil with high peat content.

It is possible that significant quantities of imported soils may have high peat content. MM05 seed mix is proposed for these areas. MM05 is a general mixture suitable for acid, neutral or alkaline peat soil, lowland or upland. The sites suitable for this seed mix are where deep or shallow peaty soils are in-filled. DBN will include the most suitable native grass seed mix.

Species List:

Bell Heather, Birdsfoot Trefoil, Bog Asphodel, Bog Cotton, Burdock, Bush Vetch, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Devil's bit Scabious, Eyebright, Fleabane*, Foxglove, Greater Trefoil, Hoary Plantain, Lesser Knapweed, Marsh Bedstraw, Marsh Cinquefoil, Marsh Ragwort, Marsh Thistle*, Meadow Buttercup, Meadowsweet, Ox-eye Daisy, Pokeweed, Purple Loosestrife, Ragged Robin, Red Bartsia, Red Campion, Red Clover, Red Rattle*, Redshank, Ribwort Plantain, Rough Hawksbit, Scented Mayweed, Sheep's Sorrell, Sorrel, Water Avens, Wild Angelica, Wild Carrot, Yarrow, Yellow Flag Iris, Yellow Loosestrife, Yellow Rattle,

Species of 'Vetches' may be added to this mixture as they become available.
Redshank can be added for very poor peat soils where other annuals will not succeed) Depending on availability: Biting Stonecrop, Eyebright*, Marsh Woundwort*, Marsh Cinquefoil, Lesser Spearwor, Marsh Loosewort, Tormentil, Marsh Marigold, Species of Sedges and Sheep's Sorrell often occur in such meadows we can add these species if required.

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or whose habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

8.4.5.2 MM09 Wild Flora and Grasses for Dry Limy Soil (alkaline, pH >7)

Product Code: MM09.

Product Name: Wild Flower Mixture for dry soil with alkaline, pH >7.

Soil which was stripped from the site and significant qualities of soil which will be imported has the characteristics to which Meadow Mixture MM09 seed mix is suited. MM09 will also suit areas of exposed rock which may or may not be lightly soiled. Meadow Mixture MM09 Dry Alkaline/ Limey Soil attract butterflies as it has a significantly large mix of flowers. This mixture forms blocks of tall single species colour capable of surviving extreme drought. This mixture is chosen for parts of the site which dry out quickly and often. The stress caused by drought will favour the species herein. Plants growing on hot dry sites seem to produce more nectar and attract a wider variety of butterflies. DBN will include the most suitable native grass seed mix.

Species List:

White Campion, Wild Carrot, Wild Parsnip, Wild White Clover, Yarrow, Yellow Agrimony, Yellow Rattle, Nottingham Catchfiy, Dames Violet, Musk Mallow, Salad Burnet, Birdsfoot, Trefoil, Black Meddick, Bladder Campion, Burdock, Burnet Saxifrage, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Cowslip, Field Scabious, Kidney Vetch, Lady's Bedstraw, Lesser Knapweed, Marjoram, Scented Mayweed, Mullein, Ox-eye Daisy, Purple Toadflax, Red Bartsia, Red Clover, Ribwort Plantain, Selfheal, St Johnswort.

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or whose habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

8.4.5.3 MM08 Wild Flora and Grasses for Moist Limy Soil (alkaline, pH >7)

Product Code: MM08.

Product Name: Wild Flower Mixture for moist soil with alkaline, pH >7.

Meadow Mixture - MM08 - Moist Alkaline/ Limey Soil is one of the very best but simplest mixtures that Design By Nature produces. Suitable for most moist (not wet) Irish soils as long as they are not acidic in pH. MM08 tends to produce tall flowers by late summer and can be cut as meadow or allowed to grow tall at the back of any shorter wildflower scheme. MM08 will also grow on fen or acid peat mixed with limestone till; such soils characteristics are present in disturbed soils where a machine has 'turned up' the more alkaline subsoil's or tills into clay top soil or peaty soils. This mix is suitable across any reinstatement site. DBN will include the most suitable native grass seed mix.

Species List:

Bell Heather, Birdsfoot Trefoil, Bog Asphodel, Bog Cotton, Burdock, Bush Vetch, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Devil's bit Scabious, Eyebright, Fleabane*, Foxglove, Greater Trefoil, Hoary Plantain, Lesser Knapweed, Marsh Bedstraw, Marsh Cinquefoil, Marsh Ragwort, Marsh Thistle*, Meadow Buttercup, Meadowsweet, Ox-eye Daisy. Pokeweed, Purple Loosestrife, Ragged Robin, Red Bartsia, Red Campion, Red Clover, Red Rattle*, Redshank, Ribwort Plantain, Rough Hawksbit, Scented Mayweed, Sheep's Sorrell, Sorrel, Water Avens, Wild Angelica, Wild Carrot, Yarrow, Yellow Flag Iris, Yellow Loosestrife, Yellow Rattle,

Species of 'Vetches' may be added to this mixture as they become available.
Redshank can be added for very poor peat soils where other annuals will not succeed) Depending on availability: Biting Stonecrop, Eyebright*, Marsh Woundwort*, Marsh Cinquefoil, Lesser Spearwort, Marsh Loosewort, Tormentil, Marsh Marigold, Species of Sedges and Sheep's Sorrell often occur in such meadows we can add these species if required.

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or whose habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

8.4.6 Quarry Plant Colour Scheme

All quarry plant and quarry infrastructures will be painted a 'dark matt, non-reflective green' on all panels as far as practically possible. This will be carried out to further minimise the visibility of the operation from the surrounding locality. The paint will be chosen according to the surface type i.e. ferrous metal and/ or galvanised metalwork. Heat and or corrosion resistant matts are also available if necessary.

8.5 Phase II – Permanent restoration of quarry faces during rock extraction

Due to the efficiency of modern extraction techniques, much less rubble and overall physical diversity is left at modern quarry faces. Consequently the process of rehabilitation must first focus on (re)establishing a landform with as much physical diversity as possible (see quarry bench sections provided in Appendix IV). This may require the blasting of quarry walls to create a greater variety of benches, angles and random physical diversity to allow different exposures to sunlight and shade and to enhance the positive visual impact following long-term vegetative development onsite. The (re)creation of ledges or benches, will without doubt, facilitates colonization by plants (Ursic et al, 1997).

Cliffs, cracks, crevices, caves, and rocky gravel/ scree slopes all possess different habitat characteristics; they can all be manufactured as part of final excavation works so, for the purposes of restoration they are discussed under one grouping.

Coshla quarries contains steep rock faces that will be enhanced to these communities by the incorporation of benches, face blasting and bench sloping and accumulation of gravels at the toe of the quarry walls wherever possible. (Appendix IV).

Most active quarries now being closed have been discouraged from including steep rock faces from a safety perspective. However there is also a significant biodiversity benefit to the establishment of these features at Coshla Quarry, it is hoped to create rock faces that mimic those that occur naturally as far as practically possible. All aspects of the proposed features are discussed below.

8.5.1 Quarry Bench Hydrology

In many cases these habitats are very dry and only receive moisture during precipitation events. However, seepage may be present in places and shaded areas in crevices may be moist and these areas may be ideal locations for the (re)establishment of vegetation. Tipping of soils on benches would also encourage moisture retention.

8.5.2 Quarry Bench Planting Mix

Vegetation is generally sparse on these rocky areas but where soil, shade and moisture are present plant growth can occur. Ferns can become established where conditions are moist and shady. As noted, the recreation of ledges contributes to the accumulation of organic matter and debris and facilitates the colonization by plant species (Ursic et al, 1997). The best suited seed mix is one of the DBN ecotype seed mixes i.e. Wild Flower Mixture for dry soil with alkaline pH >7, product code: MM09. For any benches which may be seasonally flooded then the ecotype product Native Origin Irish Wildflower Seed Mixtures for seasonally flooded benches Wetland Wild Flora (Seasonally Flooded) EC05 should be used. The locations are

outlined in the restoration plan layout drawing (Figure 2, Appendix IV) and the seed mix specifications are outlined in Appendix III.

8.5.3 Quarry Bench Fauna

Forming ledges and rock faces within the permanent restoration area would benefit the wildlife in the area such as peregrine falcon. There is also the potential for bats roosting within cracks. Cracks and crevices also are good habitats for a unique suite of invertebrates that are adapted to low-productivity habitats.

8.5.4 Quarry Bench Flora

Drawings have been provided to show the final extraction layout. This layout has been developed with long term restoration in mind. Quarry benches are proposed to provide habitat niches and to create a long term visual restoration. It has been shown at other restored limestone quarries that simple permanent rock features (as opposed to sheep rock faces) can be significantly visually restored by long term vegetation growth (see plates, Appendix I).

The following work will be carried out: -

(1) Benches will be incorporated into the quarry faces where possible during the final phases of extraction works, drawing have been provided (submitted with this report) to provide management guidance;
(2) Some benches will be side blasted to form 45^0 side slopes to the quarry face;
(3) Where possible the maximum height of a bench in the quarry is 15 metres and the proposed width of each bench will be 10 metres wide. Any face of the quarry, which is over 15 metres high, will have more than one bench of rock.
(4) Where possible the side slopes and benches will be covered in approximately 0.5 - 0.1 metres of subsoil, which will be distributed randomly along the slope. This will be covered with 200mm topsoil where possible. Several areas of benches and slopes will be left bare.
(5) The soiled areas will then be randomly planted with native trees and shrubs (where possible). These shall consist of the planting described in Phase I and as outlined in the Restoration Plan proposed layout.
(6) As no pesticides or fertilizers will be used on the topsoil the seed bank within the soil will quickly regenerate to re-establish native grasses and plants.

8.6 Phase III – Restoration of areas below surface water level

The OGE Hydrogeology Ltd., Flood Risk Assessment and Hydrogeology Assessment of the Coshla Quarry site has established the long term situation regarding the groundwater rebound levels and the long term formation of a lake with the quarry extraction hole.

As extraction in the quarry draws to completion, measures for reinstatement of the extracted area shall be put in place. The main feature of the worked out area will be a new quarry lake and all possible preparations for the formation of that lake are designed to make it support plant and animal life in the long term. The measures to be taken are as follows:

1. When production in the quarry ceases and pumping no longer takes place the water in the quarry will rise to existing groundwater levels and fluctuate according to the seasons.
2. The long term ground water levels will be between 2 and 5 meters of the present ground surface around the edge of quarry extraction hole. The lake levels will fluctuate according to these seasonal levels.
3. It has been shown that hydrologic connectivity with groundwater's and groundwater levels exists in the upper 6 meters of the quarry extraction hole i.e. groundwater movement exist to crack, fractures and fissures in the top 2 to 6 meters below ground level. The lake will gain hydrologic connectivity with groundwaters during its seasonal highs.

Lake and/ or bench-top planting works

Submerged Oxygenators – These plants shall ensure the water in the lake is sufficiently oxygenated to support a wide variety of insect life and ultimately fish stocks and frogs etc. They are to be planted as the water levels in the lake are stabilising. They are rooted in the silt/ mud where present and live entirely under water. They are important for producing underwater oxygen and shelter.

Variety	*Common Name*
Potamogeton crispus	Pondweed

Deep Water Plants – The White Water lily has the biggest flower of any native wild species in Ireland, while the Yellow Water lily has the biggest leaves of any Irish water-plant. The flowers tend to open only during sunshine, which may be an adaptation to facilitate insect pollination. The underwater stems of the water lily are fleshy and grow as deep as 6 feet below the surface of the pond. The stems are filled with air to keep their large leaves afloat.

Variety	*Common Name*
Nymphaea alba	White Water Lily
Nuphar lutea	Yellow Water Lily

Deep Marginals – Emergent plants such as Water Plantain protrude rather than float their leaves and flowers. They are, however, still rooted in the mud.

Variety	*Common Name*
Alisma plantago-aquatica	Water Plantain

Lakeside Planting – The lakeshore shall be planted with a mixture of native tree and shrub species, supporting a wide selection of wildlife. These species shall greatly add to the 'naturalisation' of the area, covering the cut faces of the rock and softening the overall visual appearance.

Variety	*Common Name*
Salix caprea	Goat Willow
Salix Alba	White Willow
Alnus glutinosa	Alder
Ulex europaeus	Gorse

8.6.1.1 Native Origin Irish Wildflower Seed Mixtures for seasonally flooded benches

Product Code: EC05

Product Name: Wetland Wild Flora (Seasonally Flooded).

EC05 is a vigorous medium tall mixture which can compete with plants common on fertile wetland soils.

Species List: Code EC05 Wetland Wild Flora (Seasonally Flooded)

Devils Bit Scabious	Red Clover	Red Rattle*
Fleabane*	Selfheal	Corn Chamomile*
Greater Trefoil	Marsh Cinquefoil*	Corn Marigold
Hemp Agrimony*	Water Avens	Corn Poppy
Lesser Knapweed	Wild Angelica	Corncockle*
Marsh Marigold	Wild Valerian*	Cornflower*
Marsh Ragwort	Yellow Flag Iris	Scented Mayweed
Meadowsweet	Yellow Rattle,	Redshank may be added for very wet soils
Purple Loosestrife	Water speedwell*	Sneezewort*
Ragged Robin		

Note: Marsh Ragwort is not the Common Ragwort noxious weed.

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or whose habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

8.7 Phase IV – Final restoration of areas after completion of extraction

The final restorations will commence after the competition of the quarry excavations.

This will consist of the following: -

4. All plant and machinery will be removed off the site;
5. The deep excavation faces will be fenced, scrub planting will be encouraged around the perimeter fence to screen the fence and provide an additional form of access restriction while providing additional vegetation on-site;
6. The quarry perimeter will be checked, all site boundaries will be secured;
7. The site infrastructure will be decommissioned and removed;
8. Where necessary, permanent structures will be demolished;
9. Areas of the quarry (outside the extraction area) will be landscaped with subsoil, topsoil and allowed to regenerate, some planting will be carried out in places. Additional planting of trees and shrubs may be necessary in some areas; the majority of these areas will be seeded with wildflower grass mixes.
10. The landscaped areas outside of the excavation area will provide topographical drainage towards the excavation hole, catchments with discharged channels to drainage areas will be incorporated where possible;
11. Areas of the quarry extraction area including quarry face benches and blasted slopes will be covered in places with subsoil, topsoil and allowed to regenerate; some planting will be carried out in places. Additional planting of trees and shrubs may be possible in some areas;
12. Management will be put in place for disposal of all hazardous substances.
13. Aftercare management will be developed in consultation with National Parks and Wildlife Service;
14. No weed killer will be used on site;
15. No fertilizer will be used on site;
16. The site will be closed and secured;
17. Exit audits as previously mentioned will be complied and submitted to the County Council.

Abandoned and closed quarries include areas of exposed bedrock; there are good opportunities to restore or to create specific exposed rock type habitats such as exposed calcareous rock ER2 on-site. It is hoped that the habitat classification of ED4 active quarries and mines can eventually develop into habitat classified as Exposed calcareous rock ER2. ER2 occurs on limestone plains, often on the same bedrock formations that are suitable for construction aggregates, as is the case at Coshla (albeit there was a glacial till overburden over much of the site prior to extraction). Many of the species of vascular plants, bryophytes,

and lichens found on quarry floors are also found on the semi natural habitat classified as Exposed calcareous rock ER2. It is clear that limestone quarry floors especially long term disused quarry floors are much more similar to naturally occurring limestone pavement ER2 (like that found in the Burren) than would be generally expected. Furthermore it is highlighted in some literature that natural processes can be responsible for roughly a 50-60% conversion of quarry to ER2 in terms of species composition. Strong evidence was found for seed limitation as the principal factor limiting the colonization of quarry floors by ER2 species (CERG, 2007). See http://www.uoguelph.ca/~umatthes/CERG/quarry_to_alvar.htm.
These areas of ER2 are expected to develop within the extraction areas and at areas left clear as part of access routes throughout the site and at areas around the extraction perimeter fence, Areas of ER2 are expected to decrease on-site as scrub vegetation colonises these areas.

8.7.1 Cliff Face and Areas of Bare Rock Limiting Factors

The presence of a suitable seed source is the principal factor limiting the colonisation of quarry floors by *Alvar species/ ER2 species (CERG, 2007). For this reason, the presence of ER2 vegetation in the surrounding area can greatly improve success; unfortunately this is not the case for the locality. Providing a seed source that should contribute to successful restoration to this habitat type will present a challenge. It is known that the persistence of an ER2 plant community improves with increasing species richness (CERG, 2007). One of the challenges in establishing ER2 vegetation at Coshla quarries will be the long term establishment of the newly planted grass and wildflower mix community. A positive point will be that following closure of the site there will be none to minimal disturbance. All details relating to the proposed wildflower and grass seed mixes are provided in Appendix III.

*Alvar is an American term used to describe a habitat not dissimilar to the Fossitt classification of Limestone Pavement (Exposed Calcareous rock ER2).

8.7.2 Proposed ER2 Soils (Cliff face benches and bare rock areas)

A mixture of silica sand gravels and till or peaty subsoil's will add the necessary nutrients, fines and carbons. The depth of the amended soil should be variable, ranging from bare rock to 15 cm to allow for a range of species. Soil in some areas should not exceed 2 cm since some or the species will only grow on the shallowest soils. There shall be no fertilisation, particularly with nitrogen, since this has been found to negatively affect plant growth in studies on ER2 (CERG, 2007).
Fertilizer addition (nitrogen and phosphorus) also typically has a negative effect on symbiotic mycorrhizal fungi, thus should not be used. Soils should be rich in arbuscular mycorrhizal fungi, which are commonly associated with herbaceous plants. habitat heterogeneity will be

increased as far as practically possible since the creation of a variety of large and small habitat types (crevices, fractures, rock piles, etc), and the use of rocky debris to create different micro-sites will all contribute to a greater amount of habitat diversity for wildlife. Human and other forms of disturbance should be minimized and this will help to ensure that species colonize the area faster.

8.7.3 Hydrology Requirements of Exposed Calcareous Rock ER2 (bare rock & cliff face)

The hydrology of Exposed calcareous rock ER2 varies a great deal over the course of the season from near-flooded to near desiccation, with the former occurring primarily during the spring (March – June) and to a lesser extent in autumn (September – November). Because the soils are very shallow (often only a few cm), they have a limited ability to retain water and so they frequently dry out from June to September (Reshcke et al, 1999). Many limestone pavement plants occur on very flat areas and depend on some seasonal flooding. If the terrain is all sloping the site may be excessively dry. More frequent ponding may develop into wetter habitats such as a marsh or fen. The amount and the timing of the water that floods a particular site must be evaluated to ensure that it is suitable for the (re)creation of limestone pavement/ alvar habitat.

8.7.3.1 MM11 Wild Flora for Dry Limy Soil (alkaline, pH >7) (Exposed rock seed mix)

This mix is suitable for application to areas of bare rock where light applications of soil may be applied, i.e. rock benches above the lake water level and along the internal gravel track.

8.7.4 Restoration of Hazardous Substances

- The following routine precautions in the removal of hazardous or polluting substances shall be adhered to at all times.
- Read the label, especially the safety precautions, carefully before removal.
- Handle all products only as recommended on the labels.
- Products shall be stored only in the containers in which they were supplied. Do not transfer them into other storage containers, especially soft drink bottles.
- Close tightly any partly full containers. Do not store any hazardous substances on site unless in a securely locked hut or trailer.
- Wash any accidental spillage from surfaces immediately.

- Wear all protective clothing recommended for the product. Wash hands and exposed skin before eating, drinking, or smoking and after the job is completed.
- Remove all used containers from site after each day's restoration work and dispose of them safely.

8.7.5 Monitoring and Adaptive Management of Restoration Projects

The monitoring of the habitat Restoration Management Plan is an important component of the entire restoration process. Monitoring will ensure that the project successfully meets its pre-set goals but also enables the early identification of shortcomings and the associated implementation of adaptive management strategies, if and when necessary.

- Surveying of elevations/ contours to determine degree of compliance with design criteria versus the end result;
- Ground and surface water measurements to determine if the desired hydrologic conditions have been established (e.g. borehole hydrometers, use of piezometers, quarry pit staff gauges, etc);
- Visual assessment of screening works;
- Follow up attention to planted vegetation to replace any die-back;
- Additional planting if necessary;
- Monitoring, control and management of invasive, exotic species;
- Submission of exit audit with implementation checklist.

9 CONCLUSIONS

This is a comprehensive restoration management plan designed specifically for the Coshla Quarries site. All aspects of restoration and long term improvement of this site have been considered. All aspects of how to achieve significant and valuable restoration of the site have been outlined here and all management procedures necessary to achieve effective restoration have been outlined here. Every detail of every aspect with relative guidance can be quickly referenced within this report for all staff/ operators/ contractors who would be involved in any works associated with restoration works at Coshla quarry. We feel that this plan offers the opportunity to reinstate the site for valuable biodiversity and agricultural proposes. It has been identified that the proposed restoration works and landscaping works at the Coshla site will not create any long term flood risk to the site or to the surrounding lands.

Guidance regarding sourcing of all seeds and plant mixes outlined in this report is provided in Appendix II and III. Guidance regarding best practice for planting all seed mixes and/ or plants recommended in the restoration plan is given in Appendix II. All proposed planting mixes e.g. woodland Planting Mix or Grassland & Wildflower Planting Mixes are defined and outlined in detail in Appendix III, specific and detailed advice and guidance regarding planting and management are also given in Appendix III. Additional guidance regarding the proposed layout and locations for all proposed planting mixes on site is clearly illustrated in the proposed Restoration Plan layout drawing given as Figure 2 in Appendix IV. Proposed final quarry face sections are also given in Appendix IV. In addition an illustration of the visual screening (including present on-site operating plant colour scheme) proposed for the quarry is given from the viewpoint of the N6 as Figure 4, Appendix IV.

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APPENDIX I

Illustrative Plates of restoration works previously managed by INIS Environmental Consultants Ltd.

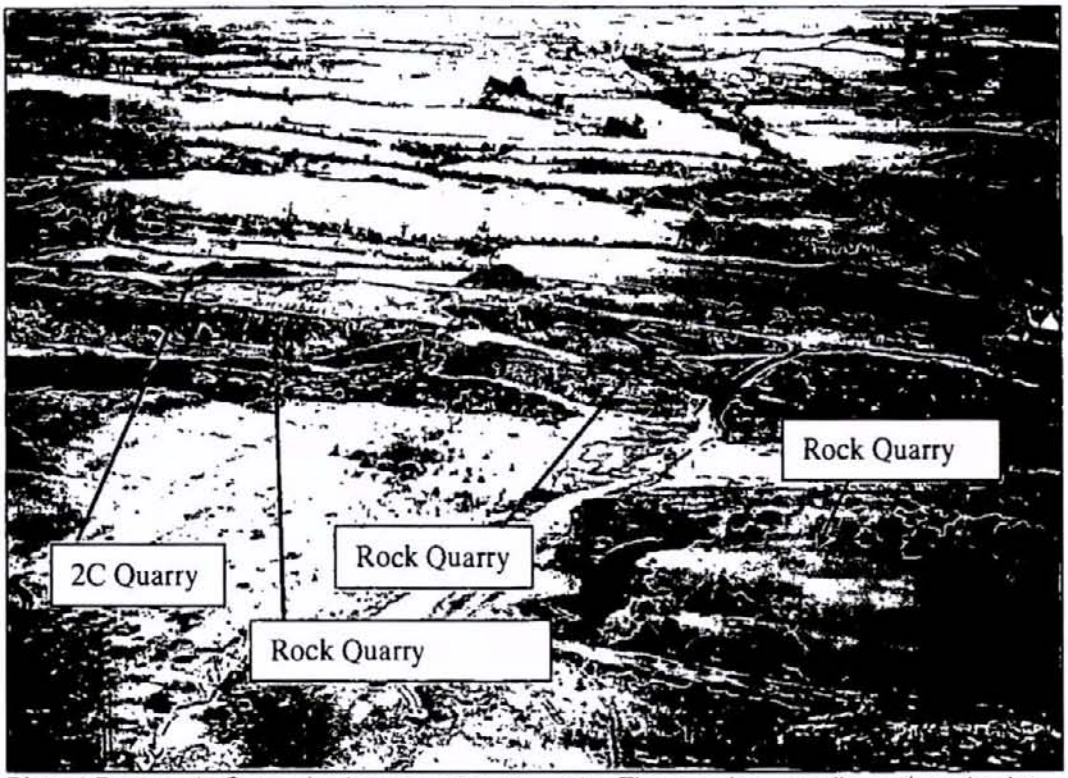

Plate 1 Rock and 2C quarries before extraction works. The quarries are adjacent/ proximal to the Ennis bypass CPO.

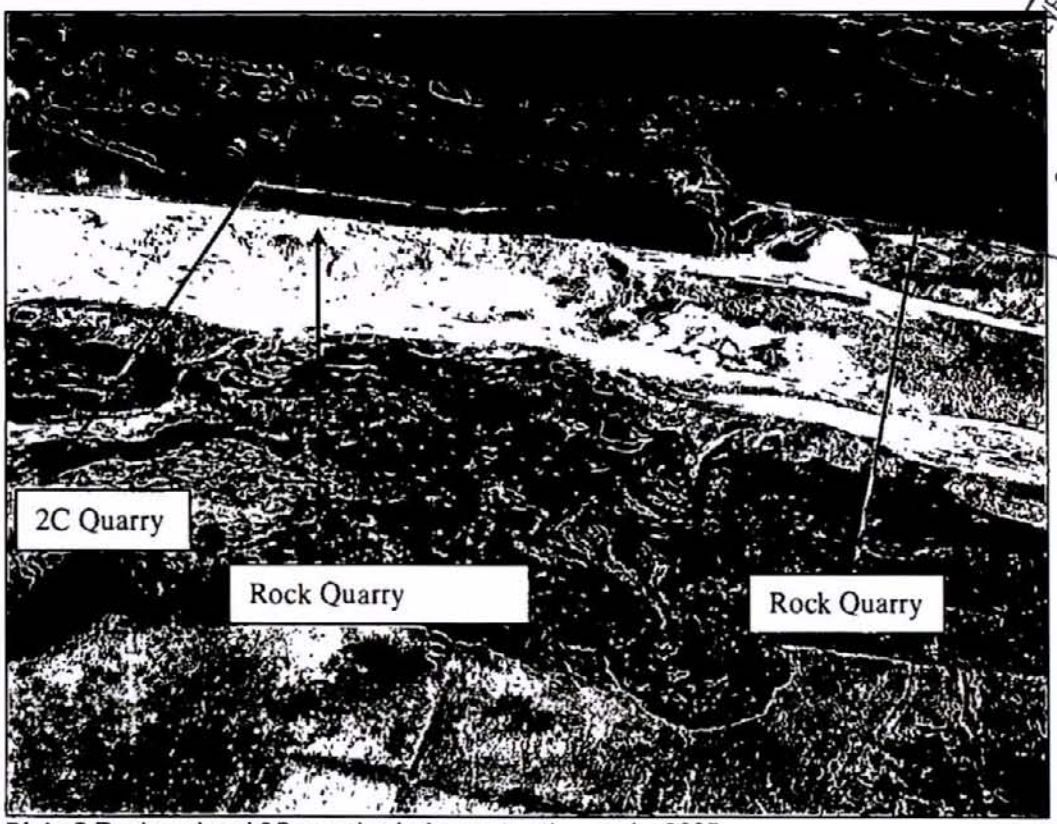

Plate 2 Rock and and 2C quarries before extraction works 2005.

Plate 3 Rock quarry during extraction during 2006.

Plate 4 Rock quarry prior to extraction 2005.

Plate 5 Rock quarry (left) and 2C quarry (right) during restoration works 2007. All hedgerows and treelines were retained.

Plate 6 2C quarry during restoration works. The toe of the now extracted hill is visible to the rear of the site. All three internal mature trees were retained.

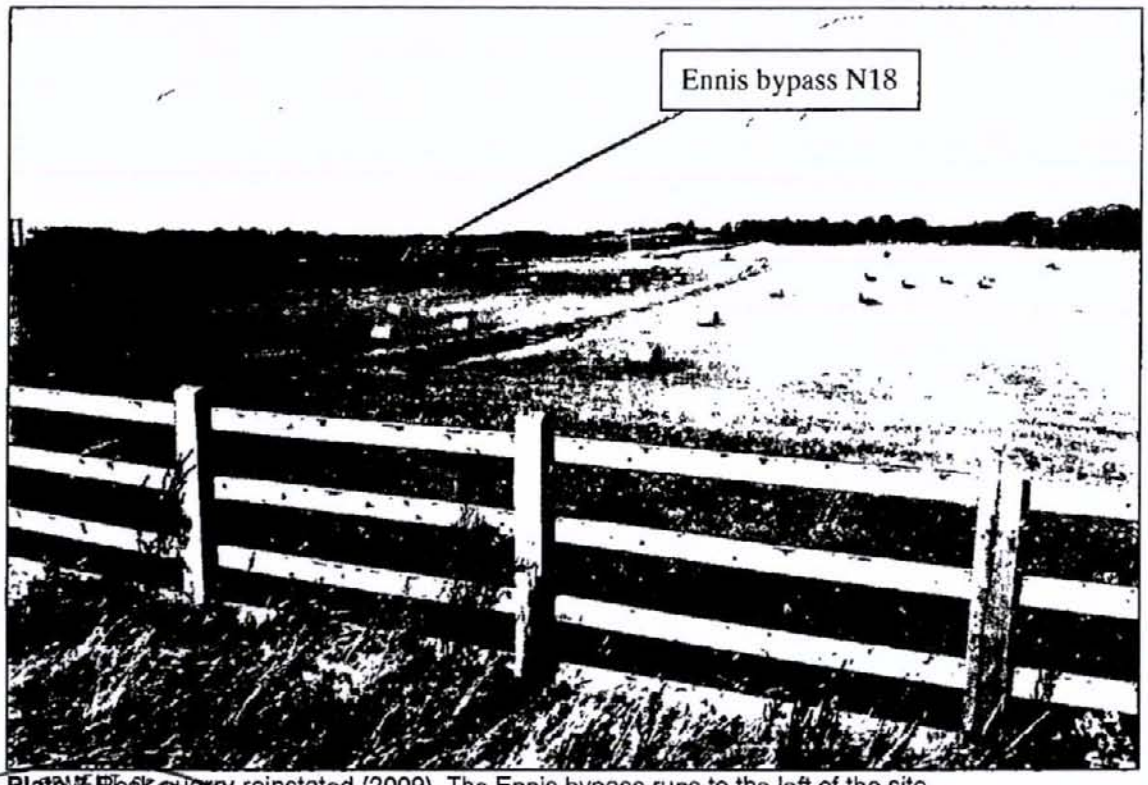

Plate 7 Rock quarry reinstated (2009). The Ennis bypass runs to the left of the site.

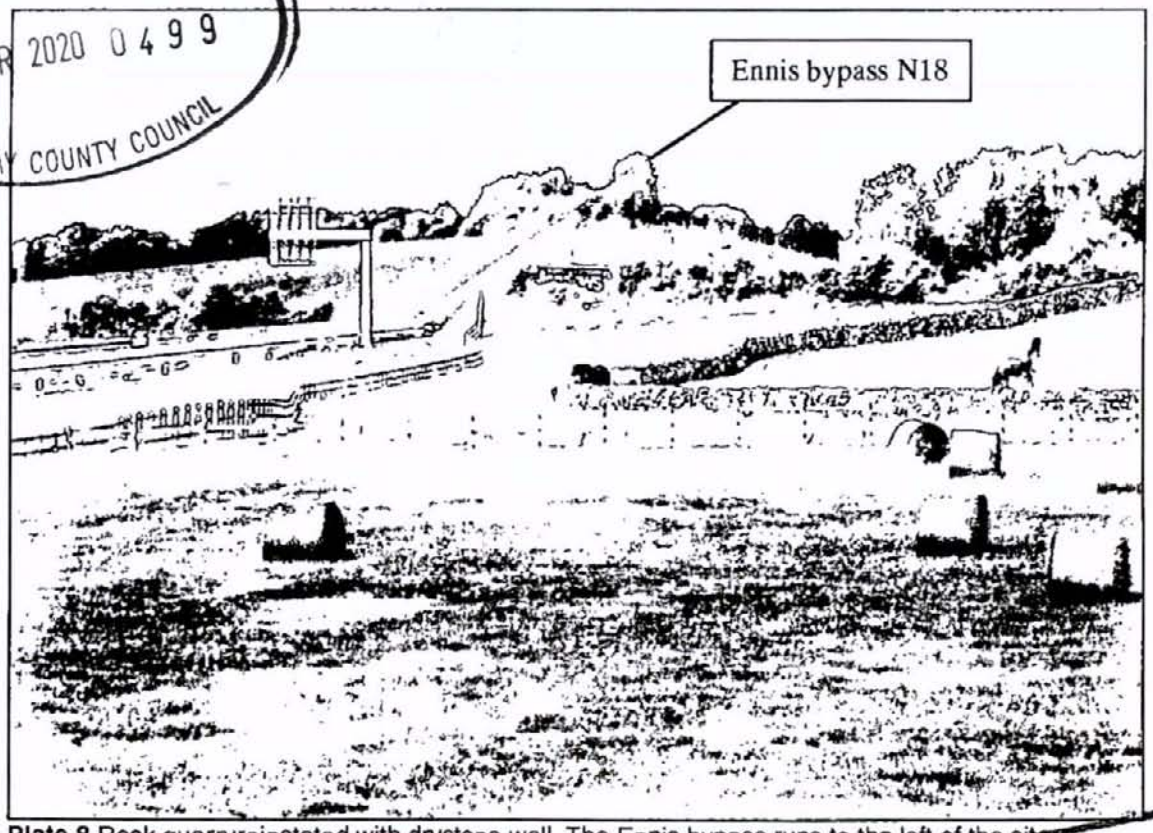

Plate 8 Rock quarryreinstated with drystone wall. The Ennis bypass runs to the left of the site.

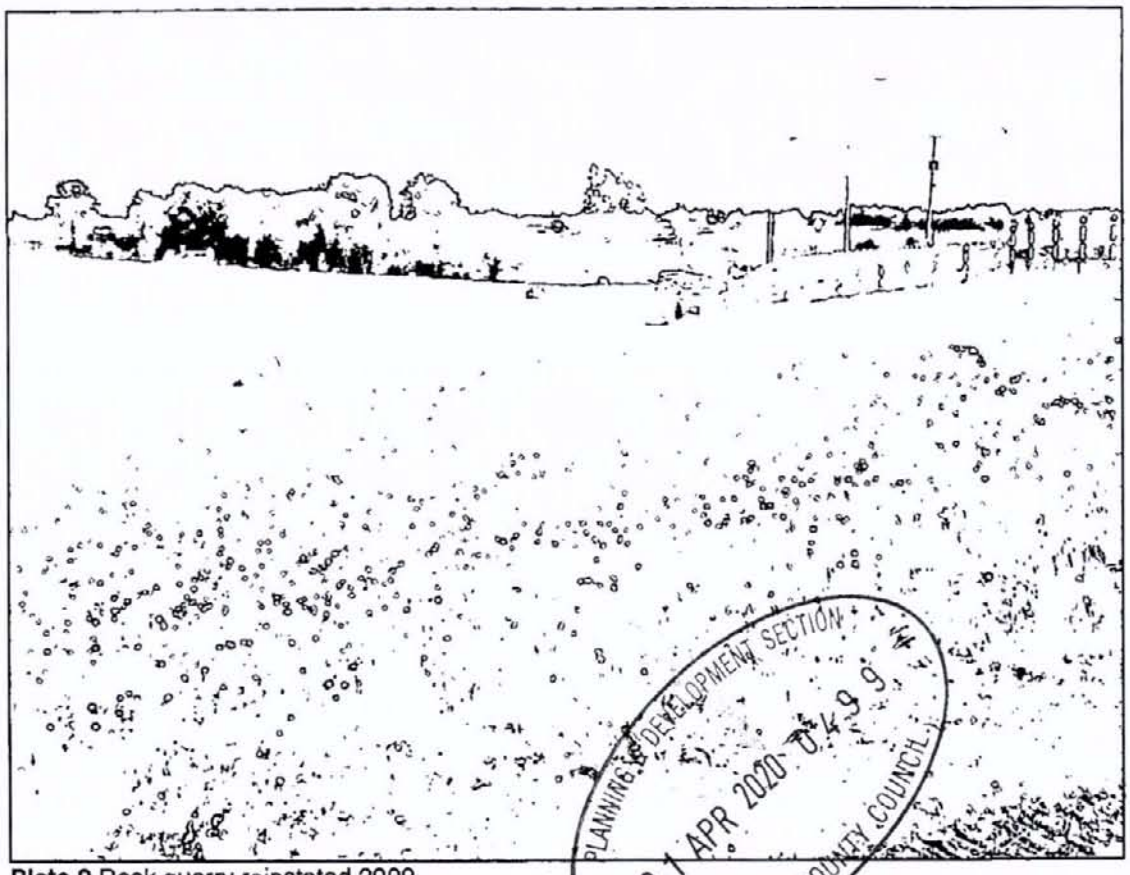

Plate 9 Rock quarry reinstated 2009.

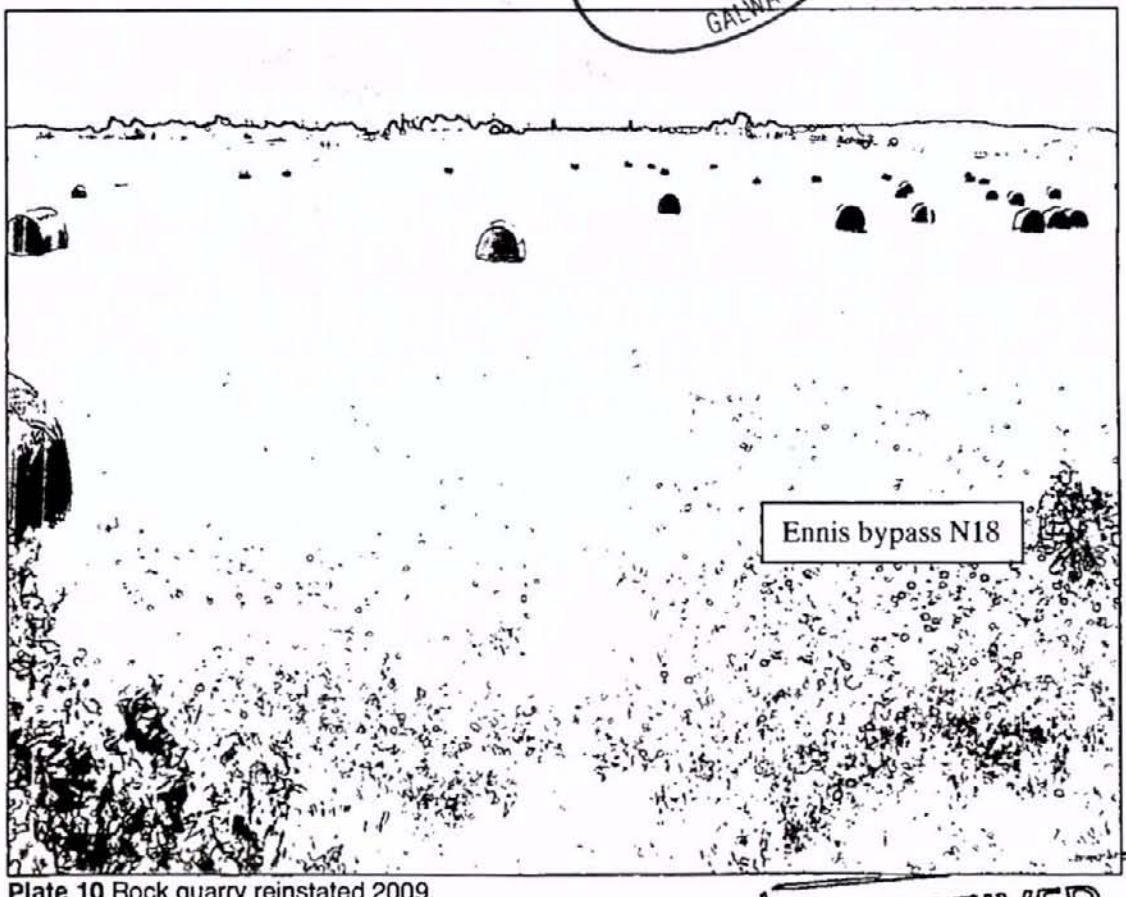

Plate 10 Rock quarry reinstated 2009.

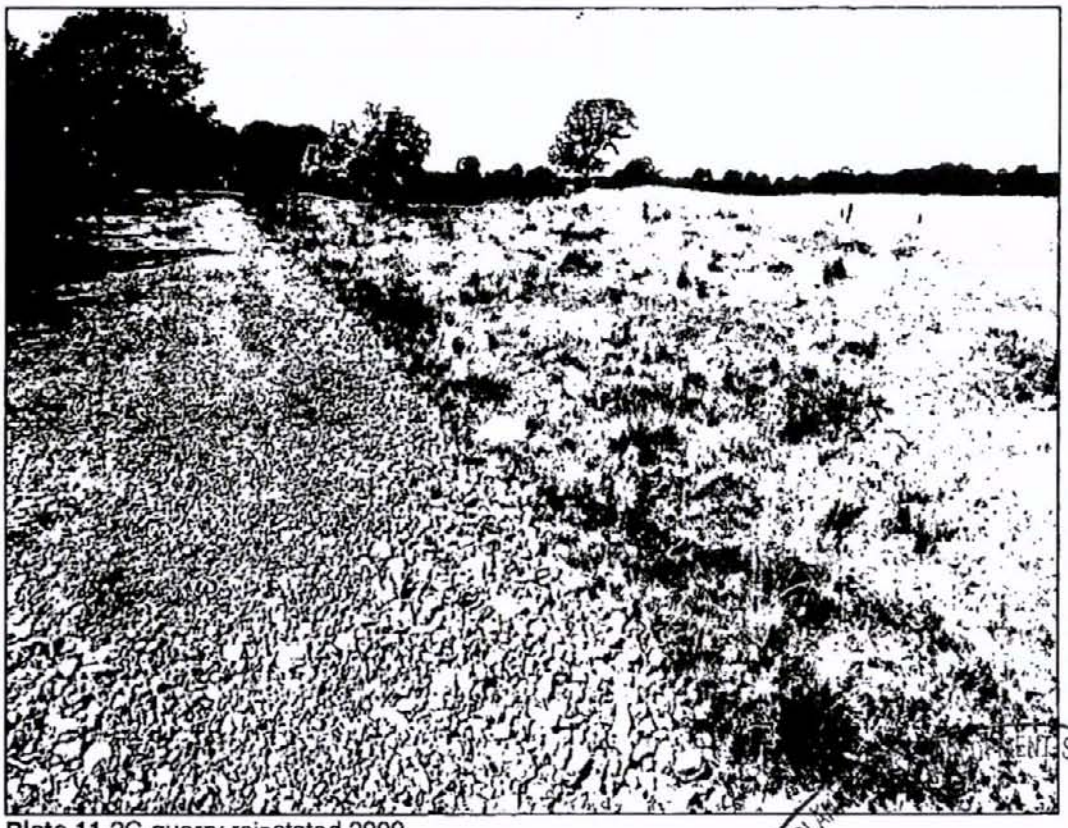

Plate 11 2C quarry reinstated 2009.

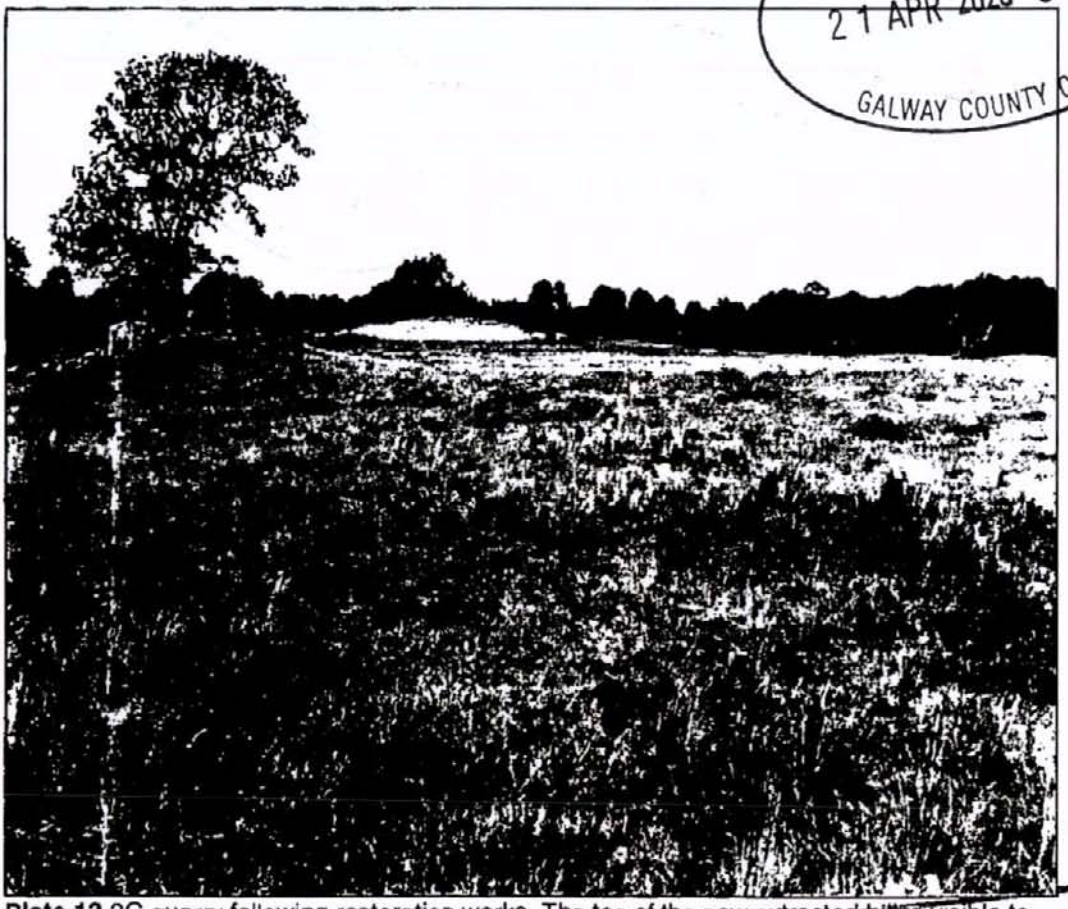

Plate 13 2C quarry following restoration works. The toe of the now extracted hill is visible to the rear of the site. All three internal mature trees were retained.

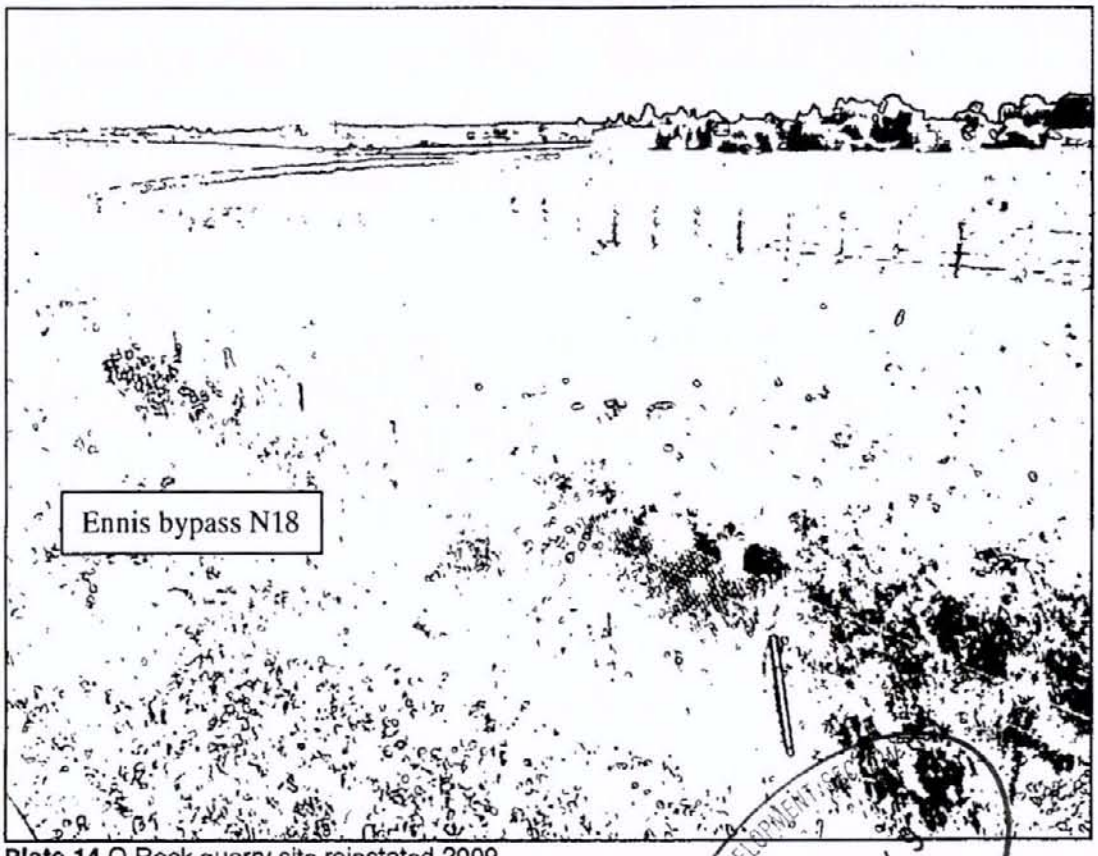

Plate 14 O Rock quarry site reinstated 2009.

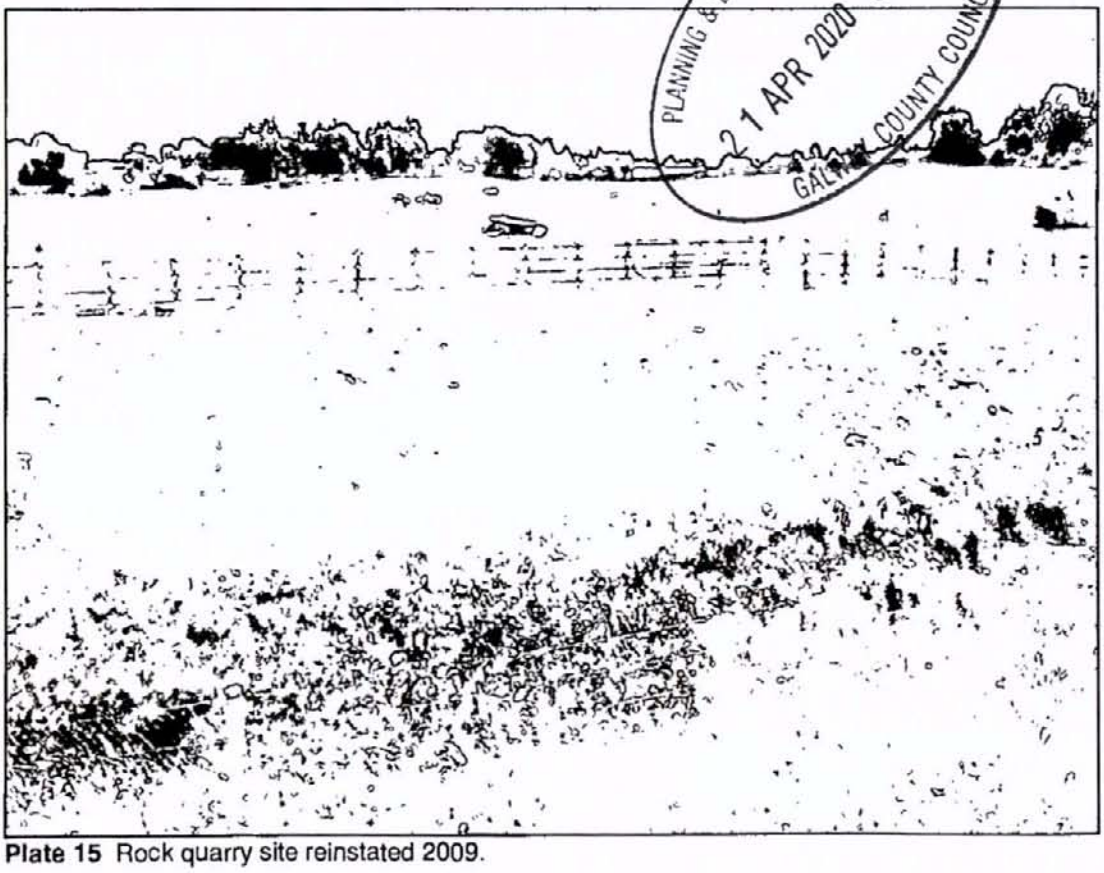

Plate 15 Rock quarry site reinstated 2009.

APPENDIX II

Supporting information and guidance documents

Choosing the right species of native tree and shrub

As mentioned, choosing the right species of tree and shrub is very important in urban areas where there are restrictions on space. Where possible, always use native species. Below is a list of the trees and shrubs native to Ireland, and advice on the locations to which they are suited.

Common name	Latin name	Height (max)	Suitable for public open spaces	Suitable for streets and confined spaces	Suitable for tubs, containers, raised beds etc.	Guide to planting: see key below
Alder	*Alnus glutinosa*	22m	Yes	No	Yes	ADPS
Alder buckthorn	*Frangula alnus*	6m	Yes	No	Yes	D
Arbutus (strawberry tree)	*Arbutus unedo*		Yes	No	Yes	
Ash	*Fraxinus excelsior*	28m	Yes	Yes	No	ADIPS
Aspen	*Populus tremula*	24m	Yes	No	No	DPSV
Bird cherry	*Prunus padus*	14m	Yes	Yes	Yes	P
Bramble	*Rubus fructicosus*					C/H
Broom	*Cytisus scoparius*	2m				
Burnet rose	*Rosa pimpinellifolia*					C/H
Common (or European) gorse	*Ulex europeaus*	2.5m				HV
Crab apple	*Malus sylvestris*	6m	Yes	No	No	AHIP
Dog rose	*Rosa canina*					C/H
Downy birch	*Betual pubescens*	18m	Yes	Yes	Yes	ADIP
Elder	*Sambucus nigra*	6m				V
Gnelder rose	*Viburnum opulus*	4.5m				DH

Hawthorn	*Crataegus monogyna*	9m				AHIPS
Hazel	*Corylus avellana*	6m				AHS
Holly	*Ilex aquifolium*	15m	Yes	No	Yes	AHPS
Honeysuckle	*Lonicera periclymenum*					C
Ivy	*Hedera helix*					C
Juniper	*Juniperus communis*	6m	Yes	No	No	
Pedunculate oak	*Quercus robur*	30m	Yes	No	No	AI
Privet	*Ligustrum vulgare*	3m				No
Purging buckthorn	*Rhamnus cathartica*	4.5m				AHPV
Rowan or mountain ash	*Sorbus aucuparia*	9m	Yes	Yes	Yes	ADHIP
Scots pine	*Pinus sylvestris*	24m	Yes	No	No	AI
Sessile oak	*Quercus petraea*	30m	Yes	No	No	AI
Silver birch	*Betula pendula*	18m	Yes	Yes	Yes	ADIP
Sloe, blackthorn	*Prunus spinosa*	3m				AHPV
Spindle	*Euonymous europaeus*	7.5m				H
Western (or monntain) gorse	*Ulex gallii*					
Whitebeam spp.	*Sorbus aria/ S. anglica/S. devoniensis /S.hibernica/S. latifolia/S. rupicola*	12m	Yes	Yes	Yes	IPS
Wild cherry	*Prunus avium*	15m	Yes	Yes	Yes	AHI

Willow spp.	*Salix spp.*	6m				V
Wych elm	*Ulmus glabr*	30m	Yes		No	PS
Yew	*Taxus baccata*	14m	Yes	No	Yes	AIPS

A – Grows in a wide variety of soils
C – Climber
H – Suitable for hedging
I – Suitable as an individual tree
D – Tolerates or prefers damp conditions
P – Tolerates smoke or pollution
S – Tolerates shade
V – Invasive

1.1 General Guide to Tree Species for Irish Farm Conditions

CONIFERS

Species	Optimum Site	Characteristics	Timber Quality	Remarks
Silka Spruce *Picea Sitchensis*	Prefers wet mineral soils and peats with previous agricultural use. Well suited to high rainfall areas. quite tolerant of exposed sites	Very fast growing tree. Avoid low rainfall areas, very dry and frost prone sites. Do not plant in single rows for shelter	Reasonably valuable whitewood. General-purpose timber known as "white deal". Used widely in the general building and construction industry	Major forest species. Non-native tree. An excellent pulpwood tree for paper, fibre and particle-board industries
Norway Spruce *Picea Abies*	Prefers less acid mineral soils and peats	Not as fast growing or as tolerant of poor sites and exposure as sikta. More suitable for planting in hollows than sikta, being more resistant to frost damage	Somewhat superior to sitka making it also suitable for joinery	Major forest species. Non-native tree. Good drainage is important to avoid windthrow. Poor wildlife tree because of its very dense shade. Suitable for shelter
Douglas Fir *Pseudotsuga Menziesii*	Prefers a moist deep well drained soil of moderate fertility	A fast grower on suitable sites. Ideally suited to sheltered valley slopes. Dislikes waterlogged and shallow soils	An excellent timber of good strength and quality, sometimes referred to as "Oregon pine" it is used for building, flooring, joinery and other uses. Much in demand for transmission poles	Major forest species. Non-native tree. Delayed thinning of crop may lead to windthrow. Poor wildlife value
Lodgepole Pine *Pinus Contorta*	Grows on the poorest of mineral and peat soils	A fast growing pioneering species. Withstands exposure better than most other species. Up to recent times was widely planted on even the most difficult of sites	A general-purpose timber, suitable for building, joinery and other uses	Minor forest species now. Non-native tree. Suffers greatly from "basal sweep" reducing the quality of the log. One of the best shelter tree species
Larch *Larix spp*	European larch prefers moist, well drained, moderately fertile loams while both Japanese and hybrid larch will tolerate a wider range of sites with a preference for high rainfall areas	Larchas are strong, light demanding, deciduous conifers. First generation hybrid is normally faster growing than Japanese and both are faster than European	All larches produce dense valuable commercial timber which is both heavier and stronger than most other softwoods	Major forest species. Non-native tree. Larchas have a high amenity and wildlife value. Produces light shade allowing ground vegetation
Scota Pine *Pinus Sylvestris*	Thrives on light textured or sandy soils. Tolerant of acid conditions. Avoid poorly drained or alkaline soils and exposure to coastal winds	A strong, light demanding slow growing tree. Can be used as a nurse species. Unsuitable for high elevations or shelter-belting	Good general-purpose softwood timber referred to as "red deal" in the trade. Suitable for construction, flooring, joinery and other uses	Major forest species. Once native but died out, now comes from imported sources. Regarded as the best conifer for both amenity and wildlife. Attracts insects, birds and red squirrels

CONIFERS

Species	Optimum Site	Characteristics	Timber Quality	Remarks
Monterey Pine *Pinus Radiata*	Light to medium textured free draining loam soils. Can be used on infertile sandy soils. Not frost hardy	Very fast growing tree but often of poor coarse branched form. Requires careful attention to seed selection preferably from new Zealand. Early and heavy pruning helps to produce a worthwhile crop	Not much known about quality of Irish grown timber. Widely used general-purpose timber in southern hemisphere, New Zealand, Australia and Chile	Minor forest species. Non-native tree. A species with potential if quality seed stock can be produced. Suitable for shelterbelts in coastal areas
Western Red Cedar *Thuja Plicata*	Requires deep free draining fertile soil. Good on alkaline soils. Avoid poor or very acid soils and exposed sites	Shade tolerant moderately fast growing tree. Useful for under-planting	Produces a lightweight timber of moderate strength. Very durable in outdoor situations, suitable for greenhouses, decking and cladding	Minor forest species. Non-native tree. Regarded as good estate tree suitable for screens, mixtures and game cover
Western Hemlock *Tsuga Heterophylla*	Can tolerate acid mineral soils and the better peats. Suitable for low rainfall areas. Avoid planting on sites where previous conifer crop suffered from butt rots	Moderate growth rates. A strong shede bearer and excellent for under-planting. Probably best established under some shade	Good durable timber suitable for quality building purposes	Minor forest species. Non-native tree which has potential for greater use
Noble Fir *Abies Noblis*	Prefers well-drained mineral soils. Tolerates moderately acid soils and is less frost tender than other firs. Has a wide pH tolerance	A fast growing tree unsuitable for very poor and dry sites. Christmas tree production may require somewhat less fertile soils	Timber may be (unfairly) regarded a being of inferior quality. Now mostly grown for Christmas tree production and foliage	Minor forest species now developing multiple uses. Non-native tree. When grown for Christmas tree production need to be well managed to produce a compact well furnished tree
Corsican Pine *Pinus Nigra var. Maritima*	Wide range of soils from sands to heavy clays. Suitable for coastal areas	Moderate growth rates but a good tree for difficult areas such as exposed areas or sandy soil	Similar to scots pine but not quite as good	Minor forest species. Non-native tree. More resistant to smoke pollution than most conifers. Suitable shelter tree
Cupressus like specias *Cupressus Chamaecyparis Cupressocyparis*	Tolerate a wide range of soils except very acid soils and raw peats	Moderate to fast growth rates but very poor stem form or coarse branching in most cases	General purpose softwood uses	Minor forest species. Non-native tree. Macrocarpa suitable for shelter in coastal areas. Leyland and Lawson although widely used for shelter-belting and screening are in most cases in-appropriate and an intrusion in the landscape

NATIVE BROADLEAVES

SPECIES	OPTIMUM SITE	CHARACTERISTICS	TIMBER QUALITY	REMARKS
Pedunculate Oak *Quercus Robur*	Well-aerated deep fertile loams. Will do well on heavier soils	Slow growing, long lived tree once the climax vegetation over most of the country	Very high quality timber suitable for many usas. Subject to timber defects when grown on adverse soils	Major forest species. One of our few native broedleaved trees. Very high amenity value
Sessile Oak *Quercus Petraea*	Tolerates less rich and lighter textured soils than *Q. robur*	Oaks will not produce good timber on excessively drained or sandy soils	Reputedly slightly better timber than *Q. robur* but site should determine choice	Major forest species. Native to Ireland. Now designated as Irish national tree
Ash *Fraxinus Excelsior*	A very exacting species demanding good soil conditions, preferably sheltered, moist well-drained fertile loam soils	A fast growing species regarded as not being suitable for large scale planting	Very high quality timber. Suitable for veneer, furniture and implement handles. High shock resistance	Major forest species. Native tree. Its wide distribution belies the difficulty in producing good quality timber
Wild Cherry *Prunus Avium*	Fertile deep well-drained mineral soils. Preference for slightly acid soils but will do well on deep loams over limestone	Fast growing, light demanding, requiring considerable space. The only commercial broadleaved tree with attractive blossoms	Produces one of the most valuable furniture and veneer timbers with a reddish brown sheen. Also used for quality turnery products	Major forest species. Native tree. High quality timber production requires good silvicultural management. A very good farm forestry tree. May suffer from bacterial canker and aphid attack
Alder *Alnus spp*	Common alder is a very hardy accommodating specias suitable for wet sites. Good wildlife species. Grey and Italian alders will tolerate and grow well on drier sites. Italian alder is has a preference for more alkaline sites	Fast growing nitrogen fixing tree. Suitable broadleaf for even the wettest sites	Durable general purpose timber with a course texture. Less used in recent times	Minor forest species. Common Alder is a native tree. Coppices freely and can be used in mixtures on very infertile sites. Valuable shelter tree
Birch *Betula spp*	Pioneer species suited to very acid soils and peats	Fast growing, hardy species, withstands exposure and frost well. Useful as a nurse crop in mixtures but must be kept under control or it will smother a slower growing tree specias	Not regarded as a timber tree in Ireland. Is used for pulp in Scandinavia	Minor forest species. Native tree. Young trees coppice freely. May be ueed as a soil improver. Can be mixed into shelterbelts
Willow *Salis spp*	Useful species for wet sites and streamsides	Fast growing useful for conservation and amenity but rarely for timber production. Willow can be used in a variety of ways as a shelterbelt system	Willow rods are regularly used for basket-making and decorative craftwork	Minor forast species. Native tree. Willow is currently being intensively studies as a suitable species for Short Rotation Forestry (Biomass) as an energy source
Whitebeam *Sorbus Aria*	Most fertile mineral soils	Attractive amenity tree also suitable for shelter	Not a timber tree	Minor forest specias. Native tree. Tolerant of exposed and coastal sites
Rowan *Sorbus Aucuparia*	Suitable for lowland and hill acidic sites. Will tolerate even alkaline sites	Hardy tree suitable for exposed sites. Widely used amenity tree	Not a timber tree	Minor forest specias. Native tree. Offers good support for wildlife

NON-NATIVE BROADLEAVES

SPECIES	OPTIMUM SITE	CHARACTERISTICS	TIMBER QUALITY	REMARKS
Beech *Fagus Sylvatica*	Well drained, loamy, fertile soils with a preference for soils derived mainly from limestone	Tolerant of shade when young. Creates dense shade and suppresses ground vegetation as it reaches maturity	Excellent timber. Wide range of uses including veneer, furniture, flooring and panelling	Major forest species. Non-native tree. Benefits from a nurse on exposed sites. Useful for under-planting. Grey squirrels can be very destructive particularly to young beech
Sycamore *Acer Pseudoplatanus*	Prefers a moderately fertile free draining soil. Tolerant of calcareous soils	Fast growing tree that seeds easily. Withstands exposure and smoke pollution very well	Tough, durable, white timber with a range of uses. Figured sycamore is much sought after for veneer and furniture manufacture	Major forest species. Non-native tree. Grey squirrels can be very harmful. A windfirm tree. Rich in wildlife value. Valuable for shelter
Poplars *Populus* Hybrid clones	Very exacting species requiring deep, well drained moderately fertile sites	Very fast growing, light demanding tree. Some species susceptible to bacterial canker, select disease rasistant clones only	Light hardwood timber with many uses. Suitable for veneer, furniture, joinery, plywood, palletwood and fruit boxes	Potentially major forest species. Non-native tree. Offers great prospects as Short Rotation Forestry species for pulpwood, paper and perticle board
Red Oak *Quercus Rubra*	Grows well on poor sandy soils	A fast growing tree, less suited to heavy soils	Yields good pale reddish brown timber, straight grained and easy to cleave but not quite so strong as Q.robur	Minor forest species. Non-native tree. High amenity because of its red and russet colours in the autumn
Horse Chestnut *Aesculus Hippocastanum*	Thrives on all except waterlogged sites but has a preference for fertile soils	An excellant amenity tree used mainly for avenues or as a specimen tree	Timber is soft, weak and of limited use	Minor forest species. Non-native tree
Walnut *Juglans spp*	Deep, well drained, loam textured, moderately fertile soil. Suitable for well sheltered sites with a southerly aspect	J. nigra grows somewhat faster than J. regia but timber may not be as highly figured. Worth pruning to give a clean stem	Strong, tough elastic, high value timber. Valuable decorative timber much used for furniture and veneer	Potentially major forest species. Non-native tree. Abnormal growths called "burr walnut" are much sought after for veneer, an example of diseased or malformed wood being more vatuable than healthy timber
Lime *Tilia spp*	Grows on a wide range of sites, but prefers moist fertile limestone soils	Relatively fast growing. Suitable for planting as an amenity tree. Attracts swarms of aphids in summertime causing sticky "honeydew" to cover foliage that drips off to ground vegetation	A very soft, light, white or yellow timber of limited use, although can be used for turnery and wood carving	Minor forest species. Non-native tree. Tree flowers are strongly scented and a great attraction for many insects and a rich source of nectar for bees
Norway Maple *Acer Platanoides*	Prefers a deep, moist, alkaline soil. Toleratas less fertile and drier sites than sycamore. Avoid exposed sites and frost hollows	Fast growing tree when young. An attractive amenity tree. Greenish yellow flower makes a beautiful sight in early spring. Brilliant red, green and gold coloured leaves in the autumn	Same as sycamore and used for similar purposes, but slightly inferior and not as attractively grained	Minor forest species. Non-native tree. Grey squirrel can be very damaging

Grass and Clover

Recommended List Varieties for Ireland 2010

Department of
Agriculture,
Fisheries and Food
An Roinn
Talmhaíochta,
Iascaigh agus Bia

CONTENTS

Requests for this booklet should be sent to:-

Department of Agriculture, Fisheries and Food (DAFF)
Crop Production & Safety Division
Backweston Campus, Young's Cross,
Celbridge, Co. Kildare.
or:-

e-mail **christine.prior@agriculture.gov.ie**

Alternatively, the information can be obtained at the Department of Agriculture, Fisheries and Food's website: -

www.agriculture.gov.ie

Enter the website and click on **Publications**

Introduction

Perennial ryegrass, Italian ryegrass and White clover account for nearly all of the grass/clover seed sold in Ireland. Of these, perennial ryegrass is by far the most important. Other species of grass and clover are not commonly used. Individual varieties differ in performance characteristics depending on maturity group and ploidy. These differences may be further exaggerated by factors such as climate, soil type and system of farming. Increased demands on grassland with regard to early spring grass, mid-season production, extended grazing in the autumn etc., mean that care needs to be taken in the selection of suitable grass seed mixtures. All grass and clover varieties listed in this booklet have a proven record of performance over a period of years at a number of different locations, and are deemed most suitable for Irish conditions.

Variety Maturity Groupings

Perennial Ryegrass: - Approximately 95% of forage grass seed sold in Ireland. Perennial ryegrass is grouped into three maturity groups (**early**, **intermediate** and **late**), on the basis of heading date (ear emergence).

Early varieties: - Head in the first half of May. The main role of early perennials is to provide early spring grazing in March and April, and to boost first cut silage yields taken by the third week of May. Early varieties perform best on light free draining soils. Stemmy re-growths in early summer can be a problem where long periods of uninterrupted growth are allowed to occur without grazing or cutting. Varieties from this group are suitable for short or medium term leys where long-term persistence is not a priority.

Intermediate varieties: - Head in the second half of May and are ideal for producing high quality silage cuts in late May and mid-July. Although not bulking up as soon as early perennial varieties, overall silage yields are as good. Varieties from this group are suited to a broad range of management systems, and should be included in any seed mixture. Spring growth is not as good as for early perennials, but persistency is better.

Late varieties: - Head in the first half of June, and tend towards a prostrate growth habit. They are characterised by high tiller densities, exhibit good ground cover, and are well suited to long term grazing pastures. Late varieties produce good quality silage cuts in early June and late July, and are leafy in mid summer. Spring growth is slow. Under good grazing management, late perennials are extremely persistent and can survive indefinitely.

Italian ryegrass: - Are best suited to short-term leys of 2-3 years duration. They have early spring growth, but can be difficult to manage in mid-season because of stemmy regrowth. Italian varieties are suitable for intensive silage production and can also provide useful grazing in the spring and late autumn period. They tend to have low sward densities and are susceptible to poaching under adverse conditions.

Hybrid ryegrass: - These varieties represent the product of a cross between Italian and Perennial ryegrass types. In appearance they generally reflect one or other parental type. The majority possess some of the out of season growth characteristics of Italians combined with some of the sward density characteristics of perennials. Compared to Italian ryegrass, hybrids exhibit a greater sward density and are usually more persistent. They also display good winter hardiness and have better mid-summer digestibility than Italians, but are poorer than Perennial ryegrass.

White clovers: - Are included as a component in most grass seed mixtures for their nutritive value and their nitrogen fixing abilities. They are classified according to leaf size into large, medium and small leafed types. Large leafed varieties are relatively tolerant to nitrogen usage and compete well with companion grasses for silage production. Medium leafed varieties are more suited to grazing, but can also be used in silage mixes.

Ploidy

Recently **diploid** varieties have tended to dominate mixtures in Ireland, but **tetraploid** varieties are an important component of grass seed mixtures. Compared to diploids they have higher quality and are more palatable to livestock (higher intake), and are more tolerant to drought. However, they tend to have lower tiller densities resulting in more open swards. Dry matter content also tends to be lower compared with diploids. On heavy soils subject to poaching, persistence may also suffer. Seeding rates for tetraploid grasses will need to be higher because of their larger seed size. In this publication, (T) denotes tetraploid varieties, all other varieties being diploid.

Growers should give preference to Recommended varieties unless there is strong evidence that some other variety is more suited to their conditions.

IMPORTANT NOTICE: - The Department of Agriculture, Fisheries and Food (DAFF) has taken all due care in evaluating the performance in Ireland of the listed varieties, for yield, heading date, ground cover and other agronomic characters (for a minimum period of 3 years) over a range of locations, soils and environmental conditions. DAFF cannot, however accept responsibility for any loss or inconvenience arising from any future variation in absolute or relative varietal performance.

Protocol for Recommended List

Varieties are evaluated from a minimum of two separate sowings and four harvest years. Trials are conducted at Backweston Farm, Leixlip, Co. Kildare (Headquarters); Fermoy, Co Cork; Raphoe, Co Donegal; Athenry, Co Galway, and Piltown, Co Kilkenny. All new varieties are assessed against control varieties within their own maturity groups.

Perennial ryegrasses are sown in autumn and assessed over the following two-year period under a 6 cut system with 350 N kg/ha applied per annum. The harvesting regime comprises two silage cuts and four grazing cuts.

Italian ryegrasses are sown in autumn and assessed over the following two-year period under a 6 cut system with 350 N kg/ha applied per annum.

Hybrid ryegrasses are sown in autumn and assessed over the following two-year period under a 6 cut system with 350 N kg/ha applied per annum.

White clover varieties are sown in a mixture with an intermediate perennial ryegrass in autumn, and following an establishment year are assessed over the subsequent two years under an 8 cut system. White clovers are tested under a low nitrogen input regime of 50 N kg/ha per annum applied in the spring.

Heading date is based on the first heading date in spring, determined by examination over a number of years at different sites. Heading date indicates the earliness or lateness of a variety in reaching maturity in spring. Dates listed should be used as a guide only as actual heading date will vary with location, climate and date of last grazing.

Total yield for each variety is given as a percentage of control varieties indicated. NB. In the tables, the mean relative yield for these control varieties does not always equate to 100, as historically not all control varieties were sown in each year from which data has been abstracted.

Ground Cover Score indicates the degree of ground cover or *sward density* at the end of the second harvest year, and is based on a visual

assessment. A low figure indicates a very open sward, which may be prone to poaching or trafficability problems. However, since most varieties are sown as a mixture, the degree that this will influence the longevity of the sward can be minimised by including varieties with high ground cover scores.

Spring growth production figures are given for all ryegrass varieties. These figures are important indicators of early grass production and are expressed as a percentage of the control yields over the same period. Spring growth data is based on the yield of the first cut, which is taken in early April.

Autumn growth figures indicate production differences between varieties in autumn. They are expressed as a percentage of the control yields over the same period. Autumn growth data is based on the combined yield of the last two cuts, which measure growth from mid-August to late October.

Grass Quality

Two measures of grass quality are presented: Dry Matter Digestibility (DMD), and Water Soluble Carbohydrate content (WSC). Results are based on testing of plot samples from all 6 cuts per year at one trial site over a minimum of two years.

Forage will provide more energy to the animal if its DMD is high. High DMD forage increases the DM intake of animals where feeding is not restricted. This increase in intake has a big effect on animal performance. Actual DMD levels can vary considerably and are influenced by several factors including growth stage and climate. The relative DMD values for individual varieties are presented in the Tables. Small differences in these values are considered relevant.

The Water Soluble Carbohydrate content of grass is a measure of its **'sugar content'**. Actual WSC levels vary widely, and are greatly influenced by the intensity and duration of sunlight in the preceding hours and days. The relative WSC values for individual varieties are presented in the Tables. Higher WSC levels are considered beneficial to animal performance. Large differences in the WSC values presented are considered relevant.

DAFF acknowledge the assistance of Teagasc, Grange, in carrying out laboratory analysis of grass samples under Stimulus Fund Project RSF 07 526.

Summary of All Recommended List Varieties 2010

Perennial ryegrass	
AberCraigs (T)	Late
AberStar	Intermediate
AberMagic	Intermediate
Anaconda (T)	Early
Cancan	Late
Cashel	Intermediate
Delphin (T)	Late
Denver	Late
Donard	Early
Dunluce (T)	Intermediate
Edda (T)	Intermediate
Glencar (T)	Late
January	Early
Lismore (T)	Intermediate
Magician (T)	Intermediate
Malambo	Late
Malone (T)	Intermediate
Mezquita	Late
Navan (T)	Late
Orion (T)	Late
Portstewart	Late
Premium	Intermediate
Shandon	Intermediate
Soriento	Late
Trend (T)	Intermediate
Twymax (T)	Late
Twystar	Late
Tyrella	Late
Tyrone	Late

Italian ryegrass
AberEpic
Fabio (T)
Nabucco (T)

Hybrid ryegrass
AberEve
Pirol
Marmota
Redunca

White clover
AberHerald
Alice
Aran
Avoca
Barblanca
Chieftain
Crusader

In all subsequent tables, grass varieties are listed in order of heading date and ploidy, with those heading earliest at the top of the list and those with the latest heading date at the bottom.

White clover varieties are shown in order of decreasing leaf size.

RECOMMENDED EARLY and INTERMEDIATE PERENNIAL RYEGRASS 2010

Variety Name	Group	Ploidy	Heading Date	Total Yield	Ground Cover 1-9	Spring Growth	Autumn Growth	DMD %	WSC %	Year 1st Listed	Breeder	Origin
Early PRG Control Mean t DM/ha				**15.6**		**1.5**	**3.2**	**80.2**	**18.9**			
Anaconda (T)	Early	T	13-May	100	5.7	99	99	101.0	106	1994	Advanta	NL
Donard	Early	D	15-May	101	6.4	101	103	100.0	96	1997	AFBI	NI
January	Early	D	17-May	100	6.0	117	99	99.0	97	2008	Teagasc	IRL
Inter PRG Control Mean t DM/ha				**15.3**		**1.3**	**3**	**81.0**	**18.8**			
Shandon	Inter	D	23-May	97	7.1	101	95	98.5	96	2005	Teagasc	IRL
Cashel	Inter	D	25-May	97	7.2	90	97	99.5	100	2000	Teagasc	IRL
Premium	Inter	D	30-May	98	7.4	94	99	99.5	96	1997	Innoseeds	NL
AberStar	Inter	D	01-Jun	100	7.0	90	108	101.0	106	2008	IBERS	UK
AberMagic	Inter	D	n/a*	102	7.5	94	115	102.0	125	2010	IBERS	UK
Malone (T)	Inter	T	22-May	104	5.8	109	108	100.5	110	2009	AFBI	NI
Magician (T)	Inter	T	24-May	103	6.6	116	102	100.5	101	1999	Teagasc	IRL
Lismore (T)	Inter	T	27-May	100	6.6	92	97	100.5	100	2006	Euro Grass	DE
Edda (T)	Inter	T	28-May	102	6.2	103	101	101.0	106	2003	NPZ	DE
Trend (T)	Inter	T	28-May	104	6.1	102	104	101.0	103	2007	NPZ	DE
Dunluce (T)	Inter	T	30-May	102	6.2	95	108	102.5	117	2007	AFBI	NI

Early PRG: variety descriptions Page 12; Control varieties Page 18.
Intermediate PRG: variety descriptions Page 12 and 13; Control varieties Page 18.
n/a = Insufficient data, considered latest of Group.

RECOMMENDED LATE PERENNIAL RYEGRASS 2010

Variety Name	Group	Ploidy	Heading Date	Total Yield	Ground Cover 1-9	Spring Growth	Autumn Growth	DMD %	WSC %	Year 1st Listed	Breeder	Origin
Late PRG Control Mean t DM/ha				14.9		1.2	3.1	81.8	19.0			
Denver	Late	D	06-Jun	98	7.5	100	97	99.5	90	2003	Advanta	NL
Soriento	Late	D	06-Jun	98	7.5	95	96	99.5	94	2005	Euro Grass	DE
Tyrella	Late	D	06-Jun	98	7.0	129	97	100.0	101	2008	AFBI	NI
Tyrone	Late	D	07-Jun	96	7.0	80	101	99.5	101	1989	AFBI	NI
Portstewart	Late	D	08-Jun	98	7.0	95	101	100.0	100	1994	AFBI	NI
Mezquita	Late	D	08-Jun	98	7.9	114	95	99.0	90	2008	Euro Grass	DE
Malambo	Late	D	11-Jun	99	7.2	98	101	n/a*	n/a*	2010	Euro Grass	DE
Cancan	Late	D	13-Jun	97	7.4	84	105	99.5	103	2000	Limagrain	Fr
Twystar	Late	D	15-Jun	97	7.1	90	98	99.0	98	1998	CPB Twyford	UK
Orion (T)	Late	T	03-Jun	100	6.6	89	97	101.0	108	2002	NPZ	DE
Delphin (T)	Late	T	03-Jun	104	6.3	113	102	100.5	103	2002	NPZ	DE
Glencar (T)	Late	T	05-Jun	102	6.5	103	100	99.5	98	2005	Teagasc	IRL
AberCraigs (T)	Late	T	06-Jun	101	6.5	102	100	100.5	108	1999	IBERS	UK
Navan (T)	Late	T	08-Jun	102	6.5	87	110	100.5	109	1999	AFBI	NI
Twymax (T)	Late	T	08-Jun	102	6.8	91	99	101.0	110	2007	CPB Twyford	UK

Late PRG: variety descriptions Page 14 and 15; Control varieties Page 18.

* n/a = insufficient data

RECOMMENDED ITALIAN and HYBRID RYEGRASS 2010

Variety Name	Group	Ploidy	Heading Date	Total Yield	Ground Cover 1-9	Spring Growth	Silage Yield	DMD %	WSC %	Year 1st Listed	Breeder	Origin
Italian Control Mean t DM/ha				**17.5**		**1.4**	**9.5**	**78.9**	**20.1**			
Nabucco (T)	Italian	T	18-May	102	5.3	110	102	99.5	99	2007	Euro Grass	DE
Fabio (T)	Italian	T	23-May	101	4.9	105	101	100.5	104	1998	Euro Grass	DE
AberEpic	Italian	D	22-May	102	5.6	121	101	99.0	102	2007	IBERS	UK
Hybrid Control Mean t DM/ha				**16.2**		**1.2**	**9.3**	**79.5**	**20.3**			
Marmota (T)	Hybrid	T	23-May	101	5.1	111	99	102.0	101	2008	Innoseeds/D	NL
Pirol	Hybrid	D	26-May	103	5.7	102	103	98.0	93	2009	Euro Grass	DE
Redunca (T)	Hybrid	T	26-May	104	5.0	116	101	99.5	101	2008	Innoseeds/D	NL
AberEve (T)	Hybrid	T	27-May	100	5.7	93	102	101.5	106	2008	IBERS	UK

Italian and Hybrid: variety descriptions Page 16; Control varieties Page 18.

RECOMMENDED WHITE CLOVER VARIETIES 2010

Variety Name	Total Yield	Leaf Size	Av Clover %	Year 1st Listed	Breeder	Origin
Control Mean t DM/ha	9.4					
Aran	99	L	44	1983	Teagasc	IRL
Alice	104	L	49	1995	Barenbrug	NL
Chieftain	101	M	35	2005	Teagasc	IRL
Avoca	102	M	46	1995	Teagasc	IRL
AberHerald	96	M	41	2003	IBERS	UK
Barblanca	103	M	56	2009	Barenbrug	NL
Crusader	94	S	48	2009	Barenbrug	NL

White Clover: variety descriptions Page 17; Control varieties Page 18.

EARLY PERENNIAL RYEGRASS: Variety Description

Anaconda (T): An early maturing tetraploid with average total yield. Combines acceptable spring growth and silage yield with good autumn growth. Ground cover is reasonable for a tetraploid variety.

Donard: A variety with good total yield and spring growth. Autumn growth and ground cover are best is group. Good mildew resistance.

January: A variety with good total yield and excellent spring growth. Ground cover is good.

INTERMEDIATE PERENNIAL RYEGRASS: Variety Description

DIPLOIDS

Shandon: Average annual yields with excellent spring growth (best in diploid group). Autumn growth is average. Good ground cover score.

Cashel: Average total yield figures with high ground cover score. Spring growth is poor.

Premium: Acceptable total yield, spring and autumn growth figures. Ground cover is also good.

AberStar: A variety with good annual yield, and good ground cover. Spring growth is poor, but it has good autumn growth. A late maturing variety with good quality values.

AberMagic: A new variety with very good annual yield. Spring growth is moderate, but autumn growth is best in group. Ground cover score is best in the group.

INTERMEDIATE PERENNIAL RYEGRASS: Variety Description

TETRAPLOIDS

Malone: A newer variety with good annual yield with excellent spring and late season growth. Ground cover is lowest in this group.

Magician: Good total annual yield. Spring growth is best in the group. Ground cover is good.

Lismore: Average total yield and autumn growth. Spring growth is below average. Ground cover score is very good.

Edda: Good total yield, with acceptable spring and autumn growth. Ground cover score is average.

Trend: Newer variety. One of the highest yielding in the group. Spring and autumn growth above average. Acceptable ground cover. Good quality parameters.

Dunluce: Newer variety. Good annual yield with excellent late season growth. Ground cover average.

LATE PERENNIAL RYEGRASS: Variety Description

DIPLOIDS

Denver: Average yielding with good spring and average autumn growth. Ground cover is very good.

Soriento: Average total yield. Spring and autumn growth satisfactory. First cut silage yield is good. Has a very good score for ground cover.

Tyrella: A newer variety. Annual yield is average with very high spring growth (highest in group). Satisfactory ground cover with good quality values.

Tyrone: Oldest variety on the list. Total yield is below average, and spring growth is poor. Above average ground cover.

Portstewart: A reliable all round performer that has withstood the test of time. Total yield and spring growth are average. Ground cover is below average.

Mezquita: A newer variety with average annual yield, and very good spring growth. Ground cover is excellent, best in the group. Quality values are below average.

Malambo: A new variety with average annual yield and spring growth. Autumn yield and ground cover are good.

Cancan: Excellent variety for late season grazing, with a high score for ground cover. Total yields are satisfactory, but spring growth is poor.

Twystar: The latest maturing variety listed, with acceptable performance across the season. Ground cover is average.

LATE PERENNIAL RYEGRASS: Variety Description

TETRAPLOIDS

Orion: A relatively early maturing variety with average total yield. Below average for spring and autumn growth. Good ground cover score.

Delphin: Exceptional early growth and total yield (best in group). Autumn growth is good. Ground cover score is the lowest in this group.

Glencar: Good annual yield figure. Spring growth is good, while autumn growth is acceptable. Ground cover score is good.

AberCraigs: Good total yield, with very good spring growth. Autumn growth is acceptable. Good silage yields. Good ground cover score. Good mildew resistance.

Navan: Very good all round variety, good yield, especially in the autumn, where it is highest in the group, with a good ground cover score. Below average spring growth.

Twymax: Very good ground cover score, highest in the group. Spring growth is below average for the group, autumn growth is average, with good silage yields.

ITALIAN RYEGRASS: Variety Description

Nabucco (T): An early tetraploid variety with good overall yields and respectable ground cover. Excellent spring growth and good silage yield.

Fabio (T): A tetraploid variety with good overall yields and spring growth. Ground cover is lowest in group. Good silage yields.

AberEpic: Highest yielding recommended variety with excellent spring growth. Silage yield is good. Forms a relatively dense sward.

HYBRID RYEGRASS: Variety Description

Marmota (T): An early tetraploid variety with good overall yields and respectable ground cover. Excellent spring growth and average silage yield.

Pirol: A new Italian type with good overall yield potential and a good ground cover score. Best silage yield in the group.

Redunca (T): A tetraploid variety with highest overall yield and excellent spring growth. Ground cover is lowest in group. Good silage yields.

AberEve: A variety with average total yield, good silage cuts and below average for spring growth. High values for ground cover indicate good persistence potential. Good values for quality parameters.

WHITE CLOVER: Variety Description

Aran: The largest leafed variety on the list. Best suited to hay or silage production as it competes well with tall grass canopies. Not persistent under hard grazing.

Alice: A high yielding variety capable of tolerating reasonable nitrogen dressings. Spring production is good. Considered to be relatively persistent..

Chieftain: Produces high yields for a medium leafed variety, with good early season growth. Suitable for grazing.

Avoca: A good yielding variety, slightly smaller in leaf size than Chieftain. Suitable for close grazing and can tolerate reasonable levels of nitrogen. Good production right across the growing season.

AberHerald: Leaf size is similar to that of Avoca. Average overall production and good persistence.

Barblanca: A new medium leaf size clover, with good production potential.

Crusader: A new small leaf clover. Below average overall production. Suitable for close grazing.

Appendix 1: Control varieties

	EARLY PRG Control Varieties
Trial sown 2004	Anaconda (T) and Donard.
Trial sown 2006	Anaconda (T) and January.

	INTER. PRG Control Varieties
Trial sown 2005	Premium, Shandon, Spelga Dunluce (T), Lismore (T), Magician (T)
Trial sown 2006	Premium, Shandon, Spelga Dunluce (T), Lismore (T), Magician (T)

	LATE PRG Control Varieties
Trial sown 2005	Denver, Portstewart, Soriento Abercraigs (T), Delphin (T), Glencar
Trial sown 2006	Denver, Cancan, Soriento Abercraigs (T), Delphin (T), Glencar

	ITALIAN Control Varieties
Trial sown 2003	Gemini (T) and Tribune.
Trial sown 2005	Fabio (T) and Ligrande

	HYBRID Control Varieties
All Trials	Pirol, Foyle (T), and Ligunda.

	WHITE CLOVER Control Varieties
All Trials	Alice, Aran, Avoca, and Aberherald.

DEPARTMENT OF AGRICULTURE, FISHERIES AND FOOD

RECOMMENDED LISTS

Cereal Varieties

Grass and Clover

Forage Maize

Winter Oilseed Rape

CROP SCHEMES AND SERVICES

Seed Certification

Seed Testing

The use of certified seed ensures a high level of varietal purity and germination.

Planting a Hedge from Cuttings

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This type of hedgerow –using cuttings- is easy to plant, grows quickly and is usually very suitable as a shelterbelt.

plants and tools required to plant 100 metres:

cuttings and trees required:

- source appropriate shrubs/trees (native and/or introduced) dependent on objectives and preferences
- number of cuttings required depends on species (see further)
- 5 hedgerow trees (oak, rowan, birch, whitebeam, wild cherry or bird cherry)

materials, tools and labour required:

- ground rock phosphate, compound fertiliser (10-10-20) or rotted farmyard manure (if necessary)
- hire of small digger / JCB with 18"-24" bucket
- hedging plastic (black, UV-stabilised polythene, 1m wide, 120 micron thick)
- pair of secateurs
- ± 5 tonnes of fine quarry dust (alternatively use a mulch)
- appropriate fence type
- 1 manday

before you start...

- the secret of planting a hedge successfully depends mainly on using good quality plants, cultivating the soil prior to planting, controlling grass and weeds and keeping browsing animals away for the first few years
- consider location, access points and traffic safety carefully
- start planning in summer, do it well and try to plant a short run of hedge every year
- fence off if necessary

site preparation is essential for successful growth

- spread well-rotted farmyard manure, compound fertiliser or ground rock phosphate where hedge is to be planted
- using a JCB or mini-digger, dig soil over to 25cm (10") deep and 50cm (2') wide, flip soil over and with the bucket teeth, loosen soil
- ensure the site has sufficient top-soil and avoid waterlogged, shallow and very exposed sites
- keep at least 1m (3.5') away from any fence or wall
- if planting (or infilling) on the site of an old hedge: remove old soil and add fresh topsoil together with some well-rotted manure
- spread out black polythene
  - 1m wide, 80-120 micron, UV-stabilised

preparing and planting cuttings

- use healthy, non-flowering cuttings
- cut into 15-30cm (6"-1') lengths just above and below a healthy bud
  - appropriate diameter and length depends on species
- prepare cuttings immediately before planting
- plant between November and February
- ensure to plant cuttings correctly by marking top and bottom differently!
- push cuttings down through plastic by punching a hole in plastic with a big nail
- plant a single or double row (avoid wet, windy or frosty conditions)
- plant density:
  - willow: 1 cutting/m and fuchsia, griselinia, escallonia, ivy,...: 3-5 cuttings/m
- spread thick layer of quarry dust, blinding, gravel, etc. over plastic
- if required: plant other plants such as blackthorn, holly, guelder rose... along plastic edge

Planting a Hedge from Cuttings

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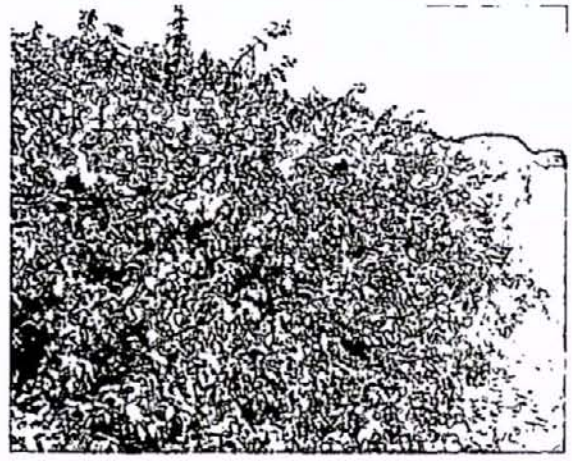
after planting care

- water newly planted cuttings during dry spells
- cut tall weeds (such as thistles, nettles, docks, etc.) growing between the plastic's edge and the fence, twice during the growing season
- pull re-colonising weeds (couch grass, buttercups, etc.) back off the gravel 3 or 4 times during the growing season using a rake or billhook

early hedge management

- monitor weed growth and carry out weeding if required
  - majority of all new hedgerows / shelterbelts fail or struggle due to poor weed control
- replace dead cuttings every winter
- trim hedge as appropriate (depending on species)
  - willow: let grow, do not cut back
  - fuchsia, griselinia, escallonia: trim regularly, cut back to 25cm (10") of current year's growth

weed control alternatives:



Biodegradable mulches

Organic mulches (straw, bark, etc.) work very well in sheltered areas. Kill off vegetation prior to soil preparation (light exclusion or herbicide). Carry out soil preparation and planting as described above but without using any plastic.

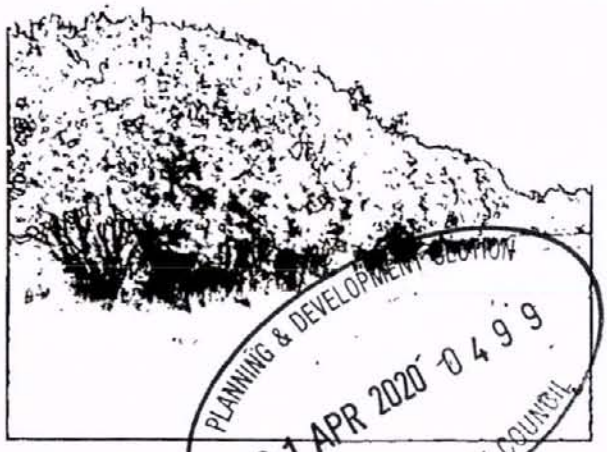
Plant trees and shrubs directly into the prepared soil. After planting, apply a thick layer of organic mulch such as straw, shredded bark, cocoa shells, rushes, etc. between the plants. For this layer to be an effective weed control barrier, it is essential to keep it topped up and raked over. Grass clippings can also be used during the growing season to control the emergence of weeds, apply well-rotted manure as mulch in the autumn.

Herbicides

Herbicides are another alternative although many hedgerows have been killed by the inappropriate use of herbicides. Use a sprayshield if required and read the label before use!

Fire brigade actions

Other weed control systems are mainly "fire brigade actions": cutting grass by using a brushcutter or hand sickle. Weeds can be pulled either by hand or by using a hoe. Weeds can also be regularly trampled. Avoid cutting or trampling plants!



general remarks:

- a range of species is more attractive and valuable to wildlife
- see the fact sheet *Selecting Hedgerow Species* for a wide range of species and ideas
- also add some trees such as ash, oak(s), rowan, field maple, hornbeam, whitebeam, elder, crab apple, wild cherry, bird cherry, wild pear (use alder or birch on damper sites) throughout the hedgerow / shelterbelt

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Selecting Hedgerow Species

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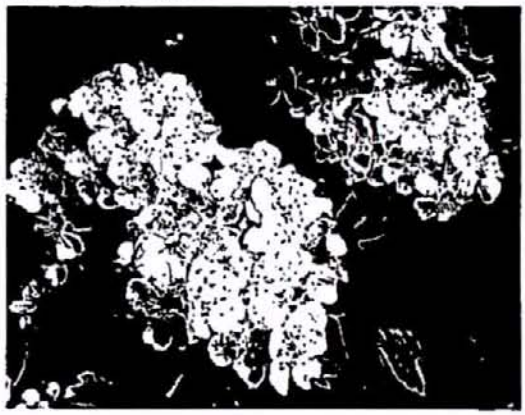
This fact sheet suggests a wide range of hedging species for both rural and urban areas. Some species are particularly attractive providing shelter, screening, flowers and a haven for wildlife.

Species for rural areas



- hawthorn (=whitethorn, quickthorn):
  - most useful hedging plant
  - tolerates a wide range of soils
  - tough, fast growing, very stock-proof
  - excellent for laying and coppicing
  - avoid planting in shady or exposed places or on top of ditches
  - plant 2-6 hawthorn/metre (in single or double staggered row)

- blackthorn (=sloe):
  - grows better on heavy soils
  - slower growing than hawthorn
  - useful for gapping up (suckers)
  - early flowering
  - tolerates exposure

- holly:
  - tolerates most soils except heavy wet clay (difficult to establish unless root-balled)
  - slow starter but very attractive
  - if berries are required: plant 10 female and 1 male plant (if planting only one, choose "JC Van Tol" or "Pyramidalis")
  - plant in May
  - will grow in shade and on old hawthorn sites
  - plant: 2-4 holly/metre

- beech (and copper beech):
  - grows well on drier, exposed, mineral soils
  - will hold on to its golden leaves over the winter if trimmed regularly
  - unable to coppice
  - plant 2-5 plants/m (in a single or double staggered row)
  - alternative in heavy ground: hornbeam

consider also:

- hazel: suitable for drier more fertile soils, very good for wildlife, prevents soil erosion, traditionally coppiced
- guelder rose: deciduous, lovely flowers, berries and autumn colours, plant 2/m
- gorse: grows well in coastal and exposed areas, striking spring flowers, very stock-proof if trimmed regularly
- field maple: tall deciduous hedge, lovely autumn colours, shade tolerant
- some trees such as: pedunculate oak, sessile oak, red oak, rowan, field maple, whitebeam, ash, crab apple, wild cherry, bird cherry, wild pear, hornbeam, elder, alder, downy birch, silver birch

Selecting Hedgerow Species

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Species for urban areas / gardens

Consider one of the following combinations for your garden:

- mixed, bird-friendly hedge with loads of berries:
  - Ilex aquifolium, Pyracantha, Sambucus nigra, Viburnum opulus, Cotoneaster lacteus, Berberis darwinii, Hippophae, Symphoricarpos

- mixed flowering hedge:
  - hawthorn, blackthorn, Forsythia, Spiraea x vanhouttei, Potentilla fruticosa, Ribes sanguineum, Rosa canina/rugosa
- mixed evergreen hedge with flowers:
  - Prunus laurocerasus 'Rotundifolia', Escallonia 'Red Elf', Ligustrum ovalifolium, Photinia 'Red Robin', Ilex aquifolium
- mixed fragrant hedge:
  - Buddleia davidii, Abeliophylum, Rosa rugosa, Philadelphus 'Virginal', Syringa vulgaris
- mixed hedge with year-round interest:
  - Berberis thunbergii atropurpurea, Cotoneaster lacteus, Pyracantha 'Red Column', Escallonia, Photinia x fraseri 'Red Robin', Viburnum opulus
  - Tamarix ramosissima, Forsythia intermedia 'spectabilis', Philadelphus 'Virginal', Ribes sanguineum 'King Edward', Viburnum bodnantense 'Dawn', Vibumum opulus 'Roseum'

Make sure to include also some trees such as:

- Amelanchier, alder, willows, spindle, red oak, rowan, field maple, whitebeam, crab apple, wild cherry, bird cherry, wild pear, elder, downey birch, silver birch

Here are some more suggestions:

Berberis thunbergii atropurpurea, B. darwinii	Very thorny, needs well-drained soil, lovely leaf, flower and berry colours, plant 3/m
Buxus sempervirens (box)	Small, neat, evergreen, slow, poisonous to livestock, trim very regularly, plant 5/m
Chaenomeles (Japanese quince)	Easy to grow, thorny, lovely flowers in early spring, plant 2-3/m
Cotoneaster simonsii	Semi-evergreen, small dark green leaves, small white flowers, red berries, shade tolerant, hardy, trim twice a year, plant 2-3/m
Escallonia spp	Evergreen, trim regularly, useful in coastal areas, not fully hardy, plant 2-3/m
Fuchsia spp	Suitable for milder areas, lovely flowers, grow from hardwood cuttings, plant 3/m
Griselinia spp	Bright green, useful in coastal areas, not very hardy, grow from cuttings, plant 3/m
Hedera hibernica (ivy)	Consider planting ivy along a fence: ivy will scramble over the fence creating an evergreen, wildlife-friendly "fedge", plant 3/m
Hypericum 'Hidcote' (St. John's wort)	Semi-evergreen, bushy, yellow flowers, plant 3/m
Ligustrum ovalifolium (privet)	Evergreen, grows in all soils, easily trimmed, plant 3-4/m
Lonicera nitida (poor man's box)	Evergreen, hardy, dense, similar to box but less neat, faster growing and much cheaper, clip at least twice a year, plant 4/m
Olearia macrodonta	Good tall screen, grey-green holly-like leaves, useful in coastal areas, not totally hardy, plant 3/m
Potentilla fruticosa	Suitable for poor soil, masses of yellow flowers, plant 2-3/m
Prunus laurocerasus 'Rotundifolia' (laurel)	Evergreen, good screen, fast-growing, can be cut back hard, glossy large leaves, plant 2-3/m
Pyracantha coccinea (firethorn)	Stockproof, hardy, nice flowers and berries, plant 2/m
Rosa canina, R. rugosa (dog / ramanas rose)	Lovely flowers and hips, thickens gradually, plant 3/m
Skimmia japonica	Lovely flowers and berries, requires acid soil, compact, plant 3-4/m
Spiraea x vanhouttei	Loads of big flowers, plant 3/m
Taxus baccata (yew)	Very long-lived, evergreen, poisonous, plant 2/m
Thuja plicata, T. occidentalis	Tall evergreen hedge, prefers well-drained soil, very hardy, plant 2-3/m

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suppliers of trees, willows and Irish apple varieties

tree suppliers (incl. Irish seed provenance):

- a local tree seed collector and tree grower: check locally!
- **Coillte Nurseries**, Pat Peters, Ballintemple, Ardattin, Co. Carlow, 059-9155018, www.coilltenurseries.ie
- **Conservation Volunteers Northern Ireland**, Tree Nursery, Dendron Lodge, Clandeboye Estate, Bangor, Co. Down, 028-9185 3570, www.cvni.org
- **Dunwiley Nurseries**, Raymond Treacy, Dunwiley, Stranorlar, Co. Donegal, 074-9131865, 087-2441354, www.dunwileynurseries.com
- **Eddie Kearney**, Co. Tipperary, 086-6017559
- **Fermoy Woodland Nurseries**, Duntaheen, Fermoy, Co. Cork., 025-31233, megerton@eircom.net
- **Finn Valley Nurseries**, Tony Gallinagh, Backlees, Stranorlar, Co. Donegal, 074-9131107, 087-2516806, www.gallinagh-nursery.com
- **Fogarty's Tree Farm & Nursery**, Co Tipperary, 067 22053
- **Future Forests**, Kealkill, Bantry, Co. Cork, 027-66176, www.futureforests.net
- **None So Hardy Nurseries**, Shillelagh, Co. Wicklow, 055-29105, www.nonesohardy.ie
- **Ulster Native Trees**, 67 Temple Rise, Templepatrick, Ballyclare, Co. Antrim, 028-9443 3068, neville.mckee@btinternet.com
- **Ulster Wildlife Trust**, Glendun Tree Nursery, Glendun Road, Glendun, Cushendun Co. Antrim, 028-2176 1403, www.ulsterwildlifetrust.org, ulsterwt@glendunfarm.fsnet.co.uk
- **Van Der Wel**, Cappagh Nurseries, Aughrim, Co. Wicklow, 0402-36595

Also check:

- magazines (Crann, The Irish Garden, Irish Timber & Forestry,...)
- Irish Timber Growers' Association Yearbook
- newspapers (Irish Farmers' Journal)
- search engines
- Golden Pages
- local garden centre
- etc.

Funded by the Irish Government under the National Development Plan 2007-2013

willow suppliers

- Rural Generation Limited, Brook Hall Estate, 65-67 Culmore Road, Derry, BT48 8JE, 028 7135 8215 (suppliers of British varieties)
- Natural Power Supply (N.P.S.), Ballymountain, Ferrybank, Waterford, 051 832777, www.nps.ie (suppliers of Swedish varieties)
- Farrelly Brothers, Carnaross, Kells, Co. Meath, 046-9240404, www.timberpro.ie/willow-project
- The Organic Centre, Rossinver, Co. Leitrim, 071-9854338, www.theorganiccentre.ie
- Northern Ireland Horticulture and Plant Breeding Station, Manor House, Loughgall, Co Armagh, BT61 8JA, 028 3889 2344
- Northern Bio Energy, Chairman James Cowan 028 86762599. Annahavil House, Moneymore, Co. Derry, BT45 7XW

Irish apple tree suppliers:

- The Organic Centre, Rossinver, Co. Leitrim, 071-9854338, www.theorganiccentre.ie
- Irish Seed Savers' Association, Capparoe, Scarriff, Co. Clare, 061-921866, www.irishseedsavers.ie

Further information:

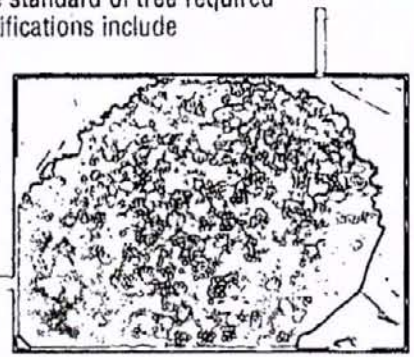
Your local Forestry Development Officer. For contact details, see www.teagasc.ie/forestry

Plant Specifications

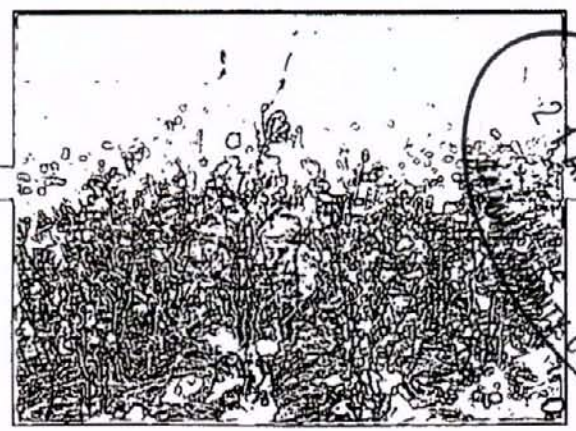
The Forest Service specifies the standard of tree required for a particular site. These specifications include

- Age
- Height
- Root Collar Diameter

Generally smaller plants are used in exposed areas while on sheltered, fertile sites a bigger plant is preferred.



Trees must be purchased from an approved nursery with a Declaration of Provenance Form and a Certificate of Provenance showing the origin of the tree seeds.



Teagasc
The Science of Farming and Food

EUROPEAN UNION

FOREST SERVICE
Department of the Marine and Natural Resources

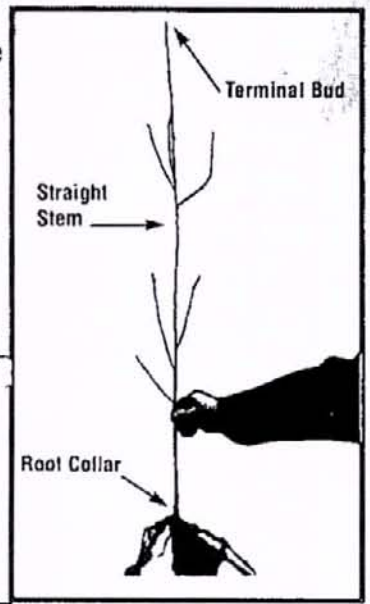
Farm Forestry Series No.6

Forestry Planting Stock - Quality and Handling

Department of the Marine and Natural Resources
Roinn na Mara agus Acmhainní Nádúrtha

Plant Quality Trees to Ensure Good Crop Establishment

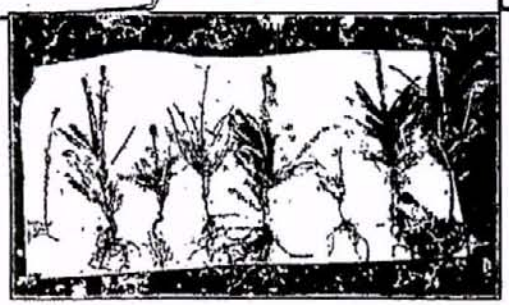
A ***quality*** plant which is ***handled*** and ***planted*** properly will survive and grow well in the forest.



Plant Quality

Ensure that the plant has a:

- healthy terminal bud
- definite leader
- sturdy root collar
- fibrous root system



Avoid Poor Quality trees

- forked leaders.
- defoliated/dead branches
- small/light trees
- j shaped root systems

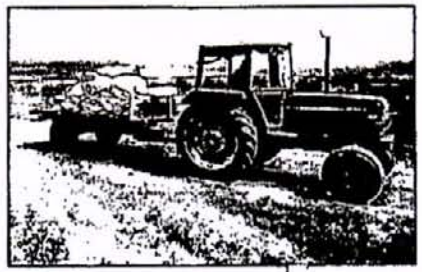
Plant Storage

Plants are normally sold from the nursery as bare rooted stock in open bundles or in light-reflecting bags (black inside and white outside - "co-extruded").

- If bagged plants are not being planted immediately they must be stored in a cool shaded area;
- Don't pile bags on top of each other, store them upright;
- Plants should not be left in bags for more than three weeks following delivery;
- If planting is delayed trees should be removed from bags and placed in trenches, covering the roots with soil;
- Always check plant quality before accepting delivery from the nursery;
- Ensure that the bags contain the correct number of trees and the grade specified;
- Check that plants have not heated in the bags.

TRANSPORT

On larger sites plants are distributed by tractor throughout the site to facilitate the planters. Roughly handled trees will result in plant failures and damaged trees.



Avoid:

- Crushing plants in bags
- Throwing bags
- Breaking plant leaders and terminal buds

PLANTING

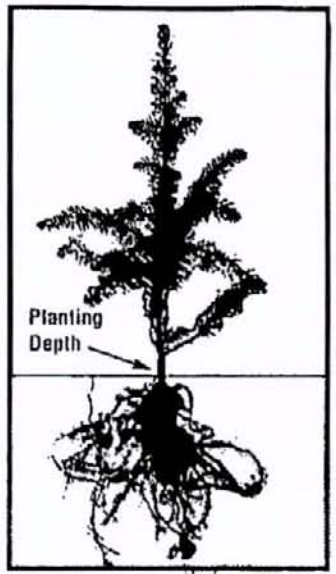
Planting method is determined by the species, root size, cultivation type, and the soil type being planted. All methods require that roots are spread evenly in the soil to facilitate good root development.

Ensure quality planting:

- Plant straight from bags without damaging young trees;
- Exposed root hairs will lead to drying out of roots;
- On mounds place trees into the best soil available.

Poor planting; exposed roots

CORRECT PLANTING TECHNIQUES



- Plant tree to the right depth (root collar just below ground level);
- Make sure that tree is planted as upright as possible;
- Firm in properly without compacting roots too tightly;
- If trees loosen over time, straighten and re-firm;
- Position roots with hands into the ground;
- Don't force roots into the ground with spade.

OPTIMUM PLANTING TIMES

- The optimum time for the planting of broadleaves is November and December;
- Larch, which flushes early, should be planted before mid-February;
- Spring planting is best for most other species;
- Trees should not be planted into frozen ground;
- The planting season can be extended by using either cold stored or containerised stock.

APPENDIX III

Seed specifications of all proposed planting mixes.

PROPOSED SEED MIXES

The different proposed seed mixes are colour coordinated or similarly indicated on the restoration plan drawings (Appendix IV), the proposed location of the specific planting mixes on-site are also indicated on the restoration plan drawings. The different proposed seed mixes and the broadly corresponding Fossitt classification codes are as follows detailed specifications regarding all aspects of the seed mixes are given below (corresponding Fossitt classification code in brackets):

(1). Woodland Planting Mix (WS2/ WL2):

(2). Scrub Planting Mix (WS1):

(3). Deep Water Planting Mix (FL8):

(4). Grassland & Wildflower Planting Mixes (GA1 & GS1):

(5). Exposed Rock Wildflower Planting Mix (ER2):

(6). Seasonally Flooded Exposed Rock Wildflower Planting Mix (ER2 & FL8):

(1). WOODLAND PLANTING MIX (WS2/ WL2):

Suppliers provided in Appendix II.

The full proposed **Woodland Planting Mix** (broadly corresponding to Fossitt classifications WS2/ WL2) is as follows:

Variety	Common Name	% of Mix	Size in cm
Corylus avellana	Hazel (NWS)	10%	
Betula pendula	Birch (NWS)	10%	60/90
Betula Alba	Downy Birch (NWS)	10%	
Ilex aquifolium	Holly (NWS)	5%	
Salix Caprea	Goat Willows (NWS)	10%	
Pinus sylvestris	Scots pine (NWS)	10%	
Fraxinus excelsior	Ash (NWS)	10%	150/180
Alnus glutinosa	Alder (NWS)	10%	60/90
Crataegus monogyna	Whitethorn	10%	60/90
Prunus spinosa	Blackthorn (NWS)	5%	60/90
Ulex Europaeus	Gorse	5%	
Rosa Canina	Dog Rose	5%	

Trees are planted at 1-metre spacing's. NWS = National Woodland Scheme.

Tree species, with the exception of the Fraxinus, shall be planted in groups of 3 on a random basis. The *Fraxinus* shall be planted in staggered rows along the embankment to create an informal screening effect. The larger *Fraxinus* shall be staked and tied as per the attached specification. An Teagasc 'General Guide to Tree Species for Irish Farm Conditions' and Native Woodland Scheme tree and shrub specifications and planting guidance is included in Appendix II to provide further planting guidance.

Note: If required the planning authority may request a non-indigenous species such as Poplar (*Populus nigra*) which are commonly used as a screening tree.

(2). SCRUB PLANTING MIX (WS1):

Suppliers provided in Appendix II.

Hawthorn,
Blackthorn,
Bramble,
Willows,

Mixed with:

Native Drigin Irish Wildflower Seed Mix, product Name: Ecotype Range - Hedgerow Wild Flower Mixture (Product Code: EC04). The Scrub Planting Mix will be used on the sides of the site perimeter soil berms and at selected location throughout the site as indicated on the restoration plan drawing.

Product Code: EC04

Product Name: Ecotype Range -Hedgerow Wild Flower Mixture.

A hedgerow mixture that requires light shade and can have additional bluebell seed added if sowing this mixture in deep shade under overhanging trees or shaded banks.

EC04 Species list:

Birdsfoot trefoil	Hedge Garlic Mustard	Red Campion
Black Meddick	Hemp Agrimony	Ribwort Plantain
Burdock	Hoary Plantain	Sorrel
Bluebell	Cow-Parsley	St Johnswort
Corn Chamomile*	Lesser Knapweed	Teasel
Corn Marigold	Scented Mayweed	Upright Hedge Parsley
Corn Poppy	Meadowsweet	Wild Angelica
Corncockle*	Mullein	Wild Carrot
Cornflower*	Ox-eye Daisy	Wood Avens
Cowslip	Purple Loosestrife	Sweet Violet
Devils Bit Scabious	Primrose	Dog Violet
Foxglove	Ragged Robin	

*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or who's habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

Seed Mixture Specifications:

Total number of seeds per gram: 2440 Native Irish Drigin Wildflower Seed Mixture EC04

Suitable for soil type: All types of soil, Clay, Loam, Sand, Light Soil, Heavy Soil, and cultivated Peat,

Moisture Level: Dry, Normal, Moist, but not Flooded Wet

pH range: Best between 5. - 7.5

Aspect: Semi Shade and Shaded. The performance will be limited under very heavy tree

canopies.

Morphology:

Life Cycle: Annual, Biennial & Perennial.

Height Range: <10cm to >180cm

Flowering Period: March to September.

Fertility Range: Will grow in very fertile soil to poor soil.

Wintergreen: Yes.

The main species which should dominate and persist in this mixture if the ground is kept free of grass and not cultivated. Cowslip, Devilsbit, Lesser Knapweed, Meadowsweet, Ox-eye Daisy, Purple Loosestrife, Ragged Robin, Ribwort Plantain, Sorrel, St Johnswort, Wood Avens,

Annual Species:

Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Scented Mayweed.

Biennial Species: Burdock, Foxglove, Mullein, Hedge Garlic Mustard, Teasel, Upright Hedge Parsley, Wild Angelica, Wild Carrot, Welsh Poppy.

Rare, unusual, and feature species: White Foxglove, Primrose,

Species which will grow if the conditions are ideal: Primrose, Sweet Violet, Dog Violet, Purple Loosestrife prefers damp soil.

Design Notes:

Can be sown with grasses, but is unnecessary, this mixture will not require a nurse crop, as it contains annuals. EC04 if sown in any light or semi shade tolerates moist or dry conditions. While the mixture will grow in full sun it will perform best when there is some shade for part of the day. This seed mixture will provide many species that are colourful in late spring. In dry areas under trees it will produce about 8 final species.

Sowing Specification:

As Normal, roll or rake into surface to keep out of reach from birds.

Soil Preparation: Normal, create fine tilt on seed bed,

Optimum Sowing Time: Autumn after leaf fall if under trees or in September or Spring in semi-shade or full sun..

Sowing Conditions: Normal Sowing seeds

Sowing Method: By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown.

Fertiliser: None. Powdered or liquid seaweed will aid germination.

Seed Sowing Rates: 1.5 grams per metre.

Normal sowing rate 'without added grass seed': 1.5 grams per metre.

High sowing rate 'without added grass seed': Add 3 grams per metre.
Low sowing rate: None.

Grass seed or nurse crop requirement:
Nurse Crop: Annuals provided in Mixture.
Grass Seed Requirement: None.
Sow with or without grasses: Unnecessary.

Seed Specification:
Up to 80% of all seed should germinate in the first year.
Up to 90% of all species should germinate in 24 months.
Up to 95% of all species should have flowered by the fourth year after sowing.
Late Autumn and early Summer sowings may be slow to emerge, depending on the weather.

Performance:
Persistence if unmanaged: Moderate.
Tolerance of Cutting: Moderate.
General Cutting Time: July or August and Early march to 10cm.
Specific Cutting Time: Wait 3 weeks until after the last flush of flowers fades away, after seeds set in July.
Management: Strim, The third year is the critical year to maintain this meadow as scutch grass, nettle and dock will try to dominate as the growing conditions are ideal for such unwanted species.

The full proposed **Scrub Planting Mix** is as follows:
Hawthorn, blackthorn, bramble, willows plus the Native Origin Irish Wildflower Seed Mixtures for side berm, product name: Ecotype Range - Hedgerow Wild Flower Mixture (Product Code: *EC04).

***A General Description of DBN wildflowers.ie Ecotype Range:**
Ecotype seed mixtures are designed to imitate natural ecologies found in specific situations. This Hedgerow mixture contains many species found in semi-shaded wild situations in Ireland. It will grow on all soils and in many different situations, if 15 to 20 species persist you have done well.

(3). DEEP WATER PLANTING MIX (FL8):

Deep Water Plant Mix - Lake planting works:

Submerged Oxygenators – These plants shall ensure the water in the lake is sufficiently oxygenated to support a wide variety of insect life and ultimately fish stocks. They are to be planted as the water levels in the lake are stabilising. They are rooted in the silt/ mud where present and live entirely under water. They are important for producing underwater oxygen and shelter.

Variety	***Common Name***
Potamogeton crispus	Pondweed

Deep Water Plants – The White Water lily has the biggest flower of any native wild species in Ireland, while the Yellow Water lily has the biggest leaves of any Irish water-plant. The flowers tend to open only during sunshine, which may be an adaptation to facilitate insect pollination. The underwater stems of the Water lily are fleshy and grow as deep as 6 feet below the surface of the pond. The stems are filled with air to keep their large leaves afloat.

Variety	***Common Name***
Nymphaea alba	White Water Lily
Nuphar lutea	Yellow Water Lily

Deep Marginals – Emergent plants such as Water Plantain protrude rather than float their leaves and flowers. They are, however, still rooted in the mud.

Variety	***Common Name***
Alisma plantago-aquatica	Water Plantain

Lakeside Planting – The lakeshore shall be planted with a mixture of native tree and shrub species, supporting a wide selection of wildlife. These species shall greatly add to the 'naturalisation' of the area, covering the cut faces of the rock and softening the overall visual appearance.

Variety	***Common Name***
Salix caprea	Goat Willow
Salix Alba	White Willow
Alnus glutinosa	Alder
Ulex europaeus	Gorse

(4). GRASSLAND & WILDFLOWER PLANTING MIXES (GA1 & GS1):

Native Origin Irish Wildflower and Grass Seed Mixes are provided by Design By Nature - Wildflowers.ie, (Ire) Crettyard, Carlow, Ireland.

Phone for quotation and advice: ++353 (0)56 4442526
Fax for quotation or advice: ++353 (0)56 4442722

Three options for three different soil types are provided to accommodate each potential soil type which may be imported, they are:

MM05 - Wildflower and Grasses Seed mixture MM05 for Soil with high peat content;
MM09 - Wildflower and Grasses Seed mixture for Dry Limy Soil (alkaline, pH >7);
MM08 - Wildflower and Grasses Seed mixture for Moist Limy Soil (alkaline, pH >7).

Native Origin Irish Wildflower and Grass Seed Mix seed specifications including relative planting details are given below under the relative headings. Grass seed will be incorporated into the mix as recommended by Design By Nature - Wildflowers.ie.

Grass seed proposed options:

Wildflower and Grasses Seed mixture MM05 – for Soil with high peat content for use over open in-filled landscaped area:

Product Code: MM05
Product Name: Wild Flower Mixture Soil with high peat content.

It is possible that significant quantities of imported soils may have high peat content. MM05 seed mix is proposed for these areas. MM05 is a general mixture suitable for acid, neutral or alkaline peat soil, lowland or upland. The sites suitable for this seed mix is where deep or shallow peaty soils is in-filled.

MM05 Mixture Specifications:
Origin: Native Irish Origin, Wildflower Seed Mixture.
Moisture Level: Suits normal, moist, or flooded wet.
pH range: Best between 5 - 7
Aspect: Sunny
Life Cycle: Annual / Biennial / Perennial.
Height Range: <30cm - > 000cm
Flowering Period: May to August.
Fertility Range: Will grow on any soil, suits fertile top soil, the less fertile the soil, the less cutting will be required.
Wintergreen: Moderate.
Total number of seeds per gram: 2132

Species List:

Bell Heather, Birdsfoot Trefoil, Bog Asphodel, Bog Cotton, Burdock, Bush Vetch, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Devil's bit Scabious, Eyebright, Fleabane*, Foxglove, Greater Trefoil, Hoary Plantain, Lesser Knapweed, Marsh Bedstraw, Marsh Cinquefoil, Marsh Ragwort, Marsh Thistle*, Meadow Buttercup, Meadowsweet, Ox-eye Daisy. Pokeweed, Purple Loosestrife, Ragged Robin, Red Bartsia, Red Campion, Red Clover, Red Rattle*, Redshank, Ribwort Plantain, Rough Hawksbit, Scented Mayweed, Sheep's Sorrell, Sorrel, Water Avens, Wild Angelica, Wild Carrot, Yarrow, Yellow Flag Iris, Yellow Loosestrife, Yellow Rattle,

Species of 'Vetches' may be added to this mixture as they become available.
Redshank can be added for very poor peat soils where other annuals will not succeed) Depending on availability: Biting Stonecrop, Eyebright*, Marsh Woundwort*, Marsh Cinquefoil, Lesser Spearwor, Marsh Loosewort, Tormentil, Marsh Marigold, Species of Sedges and Sheep's Sorrell often occur in such meadows we can add these species if required.

Sowing Specification:

Soil Preparation: Create firm, fine tilt on seed bed.
Optimum Sowing Time: Spring, early autumn, when the soil is warm.
Sowing Conditions: Normal, roll or rake into surface to keep out of reach from birds. Click
Sowing Method: By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown.
Fertiliser: None

Seed Sowing Rates:

Normal sowing rate 'without added grass seed':1.5 grams per metre.
High sowing rate 'without added grass seed': Add 3 grams per metre.

Grass seed or nurse crop requirement:

Nurse Crop: No nurse crop is required.
Grass Seed Requirement: n/a, use Bent and Fescue species, Do not use species of Perennial Rye grass
Sow with or without grasses: Either / with grasses / without grasses
Sowing rate with grasses: 2 to 7 grams per metre depending on the percentage of grass.
If sown without grass seed, this mixture: Will not require a nurse crop.

Morphology:

Life Cycle: Annual / Biennial / Perennial.

Height Range: <60cm to >180cm

Flowering Period: May to August.

Fertility Range: Will grow in any soil

Wintergreen: Partially.

The main species which should dominate and persist in this mixture: Birdsfoot Trefoil, Bog Asphodel, Bell Heather, Devil's bit Scabious, Meadow Buttercup, Greater Trefoil, Lesser Knapweed, Marsh Ragwort, Meadowsweet, Ribwort Plantain, Purple Loosestrife, Red Clover, Rough Hawksbit, Sorrel, Water Avens, Yarrow, Yellow Flag Iris, Annual Species: Red Rattle, Red Bartsia, Yellow Rattle, Eyebright,Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Scented Mayweed, Redshank. Biennial Species: Foxglove, Wild Angelica, Wild Carrot. Pokeweed, Marsh Cinquefoil, Yellow Loosestrife.

Rare, unusual, and feature species: Marsh Thistle, Marsh Woundwort, Lesser Spearwort,
Species which will grow if the conditions are ideal: Bell Heather, Bog Cotton, Ox-eye Daisy, Red Rattle, Red Bartsia, Yellow Rattle, Fleabane, Eyebright, Marsh Loosewort, Tormentil. Bog Asphodel, Marsh Bedstraw.
Species which will be affected by management: Bog Asphodel, Bell Heather,

Design Notes:

MM05 will require an open sward, to allow some species to flourish, if sedges can be encouraged instead of grasses all the better. The presents of heather requires careful cutting in the early years to allow for its establishment. Once established the heather species can be keep low to 12 cm with a general annual cut.
Moss will form on the soil surface which may need occasional raking every few years. IBN does not recommend chemically treating the moss to get ride of it.

Performance:

Peaty soil are difficult if saturated, Seek advice if sowing onto flooded peat
In normal conditions (mainly in early Autumn and Spring) this mix should germinate 3 - 8 weeks after sowing, from then on, provided the sward is kept open and a 'Thatch' is not allowed develop, species will continue to germinate and emerge, through to the third year.
First Year:
The annuals supplied in this mixture may grow and flower, it depends on what type of peat you have, for the annuals to be successful. This mixture requires one cut when finished flowering.
Second Year: In the second year the biennials will also be very colourful.
If this mixture was not cut in first year, cut and remove foliage in early Spring.

Cut again in July, August or September, depending on when flower finish or the level of weeds that emerge. In the third year this meadow mixture will seem to have less flora than the first and second year. Why? The perennial species are still young, many will only have germinated in the second season, so flowers will be sparse. However, there should be identifiable foliage and some flowers. If not contact DBN. If the native grass seeds present in your soil grow vigorously, the meadow will require two or three cuts, the first cut in Spring (April/May) and the second cut in July or August, the meadow can again be cut in September if the grasses are still growing strong.

When should this meadow be established and require one cut?
In the fourth year, when the perennials in the mixture should be flowering on many stems and starting to clump and spread, again if the grass is still vigorous cut in spring and in August the fourth year. However if the perennials are growing strong there will be no need to cut until July, August or September depending on the fertility and wetness of the soil and the species which have grown.
A wildflower meadow should last many years, provided the wildflower species were correctly established, weeds were controlled and the meadow was cut and the cut material removed and occasional 'Gaps' are created. If not contact DBN.

Persistence if unmanaged: Low
Tolerance of Cutting: Moderate.
General Cutting Time: Mid to end of Summer.
Specific Cutting Time: Wait 3 weeks until after the last flush of flowers fade away, after seeds set.

Disposal of cut materials: Always remove the cuttings, wildflower meadow hay should be removed as soon as possible and not be heaped on site as it will grow mouldy (a health risk). Meadow cuttings can be spread as compost in sheet mulches around trees and shrubs or composted.

Management: Control grasses and weeds until well established. Accept any normal non-invasive weeds as they provide cover, once the sward is established, digging, spot spraying or weed wiping can be used to eliminate problem species.
Control weeds, especially Creeping Buttercup, if Creeping Buttercup is present cut this meadow in May in year two.

MM08 Wild Flora for Moist Limy Soil (alkaline, pH >7) for use over open in-filled landscaped area:

Product Code: MM08

Product Name: Wild Flower Mixture for moist soil with alkaline, pH >7

Meadow Mixture - MM08 - Moist Alkaline/ Limey Soil is one of the very best but simplest mixtures that Design By Nature produces. Suitable for most moist (not wet) Irish soils as long as they are not acidic in pH. MM08 tends to produce tall flowers by late summer and can be cut as meadow or allowed to grow tall at the back of any shorter wildflower scheme. MM08 will also grow on fen or acid peat mixed with limestone till; such soils characteristics are present in disturbed soils where a machine has 'turned up' the more alkaline subsoil's or tills into clay top soil or peaty soils. This mix is suitable across any reinstatement site.

Mixture Specifications:

Origin: Native Irish Origin, Wildflower Seed Mixture.

Moisture Level: Not for very dry soil, suits normal, moist, but not flooded wet.

pH range: Best between 6.5 - 7.5

Aspect: Sunny

Life Cycle: Annual / Biennial / Perennial.

Height Range: <30cm - > 200cm

Flowering Period: May to August.

Fertility Range: Will grow on any soil, suits moderately fertile top soil, the less fertile the soil, the less cutting will be required.

Wintergreen: Moderate.

Total number of seeds per gram: 1560

Species List:

Bell Heather, Birdsfoot Trefoil, Bog Asphodel, Bog Cotton, Burdock, Bush Vetch, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Devil's bit Scabious, Eyebright, Fleabane*, Foxglove, Greater Trefoil, Hoary Plantain, Lesser Knapweed, Marsh Bedstraw, Marsh Cinquefoil, Marsh Ragwort, Marsh Thistle*, Meadow Buttercup, Meadowsweet, Ox-eye Daisy. Pokeweed, Purple Loosestrife, Ragged Robin, Red Bartsia, Red Campion, Red Clover, Red Rattle*, Redshank, Ribwort Plantain, Rough Hawksbit, Scented Mayweed, Sheep's Sorrell, Sorrel, Water Avens, Wild Angelica, Wild Carrot, Yarrow, Yellow Flag Iris, Yellow Loosestrife, Yellow Rattle,

Species of 'Vetches' may be added to this mixture as they become available.

Redshank can be added for very poor peat soils where other annuals will not succeed)

Depending on availability: Biting Stonecrop, Eyebright*, Marsh Woundwort*, Marsh Cinquefoil, Lesser Spearwort, Marsh Loosewort, Tormentil, Marsh Marigold,

Species of Sedges and Sheep's Sorrell often occur in such meadows we can add these species if required.

Sowing Specification:

Soil Preparation: Normal, delay site works until soil starts to dry out, create firm, fine tilt on seed bed, if clay, ensure a fine tilt or press the seed into clean soil.

Optimum Sowing Time: Early to Late spring Spring or again in early autumn, when the soil is warm.

Sowing Conditions: Normal, roll or rake into surface to keep out of reach from birds.

Sowing Method: By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown.

Fertiliser: None

Seed Sowing Rates:

Normal sowing rate 'without added grass seed':1.5 grams per metre.

High sowing rate 'without added grass seed': Add 3 grams per metre.

Low sowing rate: 1gram per metre.

Grass seed or nurse crop requirement:

Nurse Crop: No nurse crop is required.

Grass Seed Requirement: n/a, use Bent and Fescue species, Do not use species of Perennial Rye grass

Sow with or without grasses: Either / with grasses / without grasses

Sowing rate with grasses: 2 to 7 grams per metre depending on the percentage of grass.

If sown without grass seed, this mixture: Will not require a nurse crop.

Performance:

In normal conditions (mainly in early Autumn and Spring) this mix should germinate 4 - 6 weeks after sowing, from then on, provided the sward is kept open and a 'Thatch' is not allowed develop, species will continue to germinate and emerge, through to the third year.

First Year:

The annuals supplied in this mixture will flower profusely, provided they are sown before June. This mixture requires one cut when finished flowering.

Second Year: In the second year as there are no biennials this mixture will not be as colourful as others in the range, however there will be a flush of Daisies and Sorrel.

If this mixture was not cut in first year, cut and remove foliage in early Spring. Cut again in July or August, Do not leave it until September, as it will be too late for this mixture.

In the third year this meadow mixture will seem to have less flora than the first and second

year. Why? The perennial species are still young, many will only have germinated in the second season, so flowers will be sparse. However, in May there should be good colour from the Ragged Robin and Buttercups, and if you look close, lots of identifiable foliage and some flowers from the other species. If not contact us.

If the native grass seeds present in your soil grow vigorously, the meadow will require two or three cuts, the first cut in Early April and the second cut in late July or August, the meadow can again be cut in September if the grasses are still growing strong.

When should this meadow be established and require one cut? In the fourth year, when the perennials in the mixture should be flowering on many stems and starting to clump and spread, again if the grass is still vigorous cut in spring and in August of the fourth year. However if the perennials are growing strong there will be no need to cut until July, August or September depending on the fertility and wetness of the soil and the species which have grown. A wildflower meadow should last many years, provided the wildflower species were correctly established, weeds were controlled and the meadow was cut and the cut material removed and occasional 'Gaps' are created. If not contact DBN.

Persistence if unmanaged: This should be cut once every year, but if the ground is too wet to cut, leaving the cutting for a year will only damage some species and the meadow should survive.

Tolerance of Cutting: High after second year.

General Cutting Time: Mid to end of Summer and again in spring.

Specific Cutting Time: April, to keep trimmed and tidy.

Disposal of cut materials: Always remove the cuttings, wildflower meadow hay should be removed as soon as possible and not be heaped on site as it will grow mouldy (a health risk). Meadow cuttings can be spread as compost in sheet mulches around trees and shrubs or composted.

Management:

Control grasses and weeds until well established. Accept any normal non-invasive weeds as they provide cover, once the sward is established, digging, spot spraying or weed wiping can be used to eliminate problem species. Control weeds, especially Creeping Buttercup, if Creeping Buttercup is present cut this meadow in May in year two. The third year is the critical year to maintain this meadow as scutch grass, creeping thistle, nettle and dock will try to dominate as the growing conditions are ideal for such unwanted species.

MM09 Wild Flora for dry Limy Soil (alkaline, pH >7) for use over open in-filled landscaped area:

Product Code: MM09
Product Name: Wild Flower Mixture for dry limy soil with alkaline, pH >7

Soil which was stripped from the site and significant qualities of soil which will be imported fits the characteristics to which Meadow Mixture MM09 seed mix is suited. MM09 will also suit areas of exposed rock which may or may not be lightly soiled. Meadow Mixture MM09 Dry Alkaline/ Limey Soil attracts butterflies as it has a significantly large mix of flowers. This mixture forms blocks of tall single species colour capable of surviving extreme drought. This mixture is chosen for parts of the site which dry out quickly and often. The stress caused by drought will favour the species herein. Plants growing on hot dry sites seem to produce more nectar and attract a wider variety of butterflies.

Mixture Specifications:

Origin: Native Irish Origin, Wildflower Seed Mixture.
Moisture Level: For very dry soil, suits normal, but not moist or flooded wet.
pH range: Best between 6.5 - 7.9
Aspect: Sunny Life Cycle: Annual / Biennial / Perennial.
Height Range: 30cm - 120cm
Flowering Period: May to August.
Fertility Range: The less fertile the soil, the less cutting will be required.
Wintergreen: Moderate
Total number of seeds per gram: 1258

Species List:

White Campion, Wild Carrot, Wild Parsnip, Wild White Clover, Yarrow, Yellow Agrimony, Yellow Rattle, Nottingham Catchfly, Dames Violet, Musk Mallow, Salad Burnet, Birdsfoot, Trefoil, Black Meddick, Bladder Campion, Burdock, Burnet Saxifrage, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Cowslip, Field Scabious, Kidney Vetch, Lady's Bedstraw, Lesser Knapweed, Marjoram, Scented Mayweed, Mullein, Ox-eye Daisy, Purple Toadflax, Red Bartsia, Red Clover, Ribwort Plantain, Selfheal, St Johnswort.

Sowing Specification:

Soil Preparation: Normal, create firm, fine tilt on seed bed, if clay, ensure a fine tilt or press the seed into clean soil.
Optimum Sowing Time: Spring, early autumn, when the soil is warm.
Sowing Conditions: Normal, roll or rake into surface to keep out of reach from birds.

Sowing Method: By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown. Click here for more details
Fertiliser: None

Seed Sowing Rates:
Normal sowing rate 'without added grass seed':1.5 grams per metre.
High sowing rate 'without added grass seed': Add 3 grams per metre.

Grass seed or nurse crop requirement:
Nurse Crop: No nurse crop is required.
Grass Seed Requirement: n/a, use Bent and Fescue species, Do not use species of Perennial Rye grass
Sow with or without grasses: Either / with grasses / without grasses
Sowing rate with grasses: 2 to 7 grams per metre depending on the percentage of grass.
If sown without grass seed, this mixture: Will not require a nurse crop.

Performance:
In normal conditions (mainly in early Autumn and Spring) this mix should germinate 3 - 6 weeks after sowing, from then on, provided the sward is kept open and a 'Thatch' is not allowed develop, species will continue to germinate and emerge, through to the third year.
First Year:
The annuals supplied in this mixture will flower profusely, provided they are sown before June. This mixture requires one cut when finished flowering.
Second Year: In the second year the biennials will also be very colourful.
If this mixture was not cut in first year, cut and remove foliage in early Spring. Cut again in July, August or September, depending on when flower finish or the level of weeds that emerge.
In the third year this meadow mixture will seem to have less flora than the first and second year. Why?
The perennial species are still young, many will only have germinated in the second season. However, there should be identifiable foliage and some flowers. If not contact us.
If the native grass seeds present in your soil grow vigorously, the meadow will require two or three cuts, the first cut in Spring (April/May) and the second cut in July or August, the meadow can again be cut in September if the grasses are still growing strong.
When should this meadow be established and require one cut?
In the fourth year, when the perennials in the mixture should be flowering on many stems and starting to clump and spread, again if the grass is still vigorous cut in spring and in August of the fourth year. However if the perennials are growing strong there will be no need to cut until

July, August or September depending on the fertility and wetness of the soil and the species which have grown.
A wildflower meadow should last many years, provided the wildflower species were correctly established, weeds were controlled and the meadow was cut and the cut material removed and occasional 'Gaps' are created. If not contact DBN.

Persistence if unmanaged: Moderate

Tolerance of Cutting: High after second year.

General Cutting Time: Mid to end of Summer and again in spring if required.

Specific Cutting Time: Mid August, wait 3 weeks until after the last flush of flowers fade away, after seeds set.

Disposal of cut materials: Always remove the cuttings, wildflower meadow hay should be removed as soon as possible and not be heaped on site as it will grow mouldy (a health risk). Meadow cuttings can be spread as compost in sheet mulches around trees and shrubs or composted.

Management:
Control grasses and weeds until well established. Accept any normal non-invasive weeds as they provide cover, once the sward is established, digging, spot spraying or weed wiping can be used to eliminate problem species.

(5). EXPOSED ROCK WILDFLOWER PLANTING MIX (ER2):

Product Code: MM09

Product Name: Wild Flower Mixture for dry soil with alkaline, pH >7

Soil which was stripped from the site and significant qualities of soil which will be imported fits the characteristics to which Meadow Mixture MM09 seed mix is suited. MM09 will also suit areas of exposed rock which may or may not be lightly soiled. Meadow Mixture MM09 Dry Alkaline/ Limey Soil attracts butterflies as it has a significantly large mix of flowers. This mixture forms blocks of tall single species colour capable of surviving extreme drought. This mixture is chosen for parts of the site which dry out quickly and often. The stress caused by drought will favour the species herein. Plants growing on hot dry sites seem to produce more nectar and attract a wider variety of butterflies.

Mixture Specifications:

Origin: Native Irish Origin, Wildflower Seed Mixture.

Moisture Level: For very dry soil, suits normal, but not moist or flooded wet.

pH range: Best between 6.5 - 7.9

Aspect: Sunny Life Cycle: Annual / Biennial / Perennial.

Height Range: 30cm - 120cm

Flowering Period: May to August.

Fertility Range: The less fertile the soil, the less cutting will be required.

Wintergreen: Moderate

Total number of seeds per gram: 1258

Species List:

White Campion, Wild Carrot, Wild Parsnip, Wild White Clover, Yarrow, Yellow Agrimony, Yellow Rattle, Nottingham Catchfly, Dames Violet, Musk Mallow, Salad Burnet, Birdsfoot, Trefoil, Black Meddick, Bladder Campion, Burdock, Burnet Saxifrage, Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Cowslip, Field Scabious, Kidney Vetch, Lady's Bedstraw, Lesser Knapweed, Marjoram, Scented Mayweed, Mullein, Ox-eye Daisy, Purple Toadflax, Red Bartsia, Red Clover, Ribwort Plantain, Selfheal, St Johnswort.

Sowing Specification:

Soil Preparation: Normal, create firm, fine tilt on seed bed, if clay, ensure a fine tilt or press the seed into clean soil.

Optimum Sowing Time: Spring, early autumn, when the soil is warm.

Sowing Conditions: Normal, roll or rake into surface to keep out of reach from birds.

Sowing Method: By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown. Click here for more details
Fertiliser: None

Seed Sowing Rates:
Normal sowing rate 'without added grass seed':1.5 grams per metre.
High sowing rate 'without added grass seed': Add 3 grams per metre.

Grass seed or nurse crop requirement:
Nurse Crop: No nurse crop is required.
Grass Seed Requirement: n/a, use Bent and Fescue species, Do not use species of Perennial Rye grass
Sow with or without grasses: Either / with grasses / without grasses
Sowing rate with grasses: 2 to 7 grams per metre depending on the percentage of grass.
If sown without grass seed, this mixture: Will not require a nurse crop.

Performance:
In normal conditions (mainly in early Autumn and Spring) this mix should germinate 3 - 6 weeks after sowing, from then on, provided the sward is kept open and a 'Thatch' is not allowed develop, species will continue to germinate and emerge, through to the third year.
First Year:
The annuals supplied in this mixture will flower profusely, provided they are sown before June. This mixture requires one cut when finished flowering.
Second Year: In the second year the biennials will also be very colourful.
If this mixture was not cut in first year, cut and remove foliage in early Spring. Cut again in July, August or September, depending on when flower finish or the level of weeds that emerge.
In the third year this meadow mixture will seem to have less flora than the first and second year. Why?
The perennial species are still young, many will only have germinated in the second season. However, there should be identifiable foliage and some flowers. If not contact us.
If the native grass seeds present in your soil grow vigorously, the meadow will require two or three cuts, the first cut in Spring (April/May) and the second cut in July or August, the meadow can again be cut in September if the grasses are still growing strong.
When should this meadow be established and require one cut?
In the fourth year, when the perennials in the mixture should be flowering on many stems and starting to clump and spread, again if the grass is still vigorous cut in spring and in August of the fourth year. However if the perennials are growing strong there will be no need to cut until

July, August or September depending on the fertility and wetness of the soil and the species which have grown.
A wildflower meadow should last many years, provided the wildflower species were correctly established, weeds were controlled and the meadow was cut and the cut material removed and occasional 'Gaps' are created. If not contact DBN.

Persistence if unmanaged: Moderate

Tolerance of Cutting: High after second year.

General Cutting Time: Mid to end of Summer and again in spring if required.

Specific Cutting Time: Mid August, wait 3 weeks until after the last flush of flowers fade away, after seeds set.

Disposal of cut materials: Always remove the cuttings, wildflower meadow hay should be removed as soon as possible and not be heaped on site as it will grow mouldy (a health risk). Meadow cuttings can be spread as compost in sheet mulches around trees and shrubs or composted.

Management:

Control grasses and weeds until well established. Accept any normal non-invasive weeds as they provide cover, once the sward is established, digging, spot spraying or weed wiping can be used to eliminate problem species.

(6). SEASONALLY FLOODED EXPOSED ROCK WILDFLOWER PLANTING MIX (ER2 & FL8):

Seasonally Flooded Exposed Rock Wildflower Mix - Native Origin Irish Wildflower Seed Mixtures for seasonally flooded benches

Seasonally flooded quarry bench Mix: Native Origin Irish Wildflower Seed Mix. Product Name: Wetland Wild Flora (Seasonally Flooded).

Product Code: EC05
Product Name: Wetland Wild Flora (Seasonally Flooded)

EC05 is a vigorous medium tall mixture which can compete with plants common on fertile wetland soils.

Species List: Code EC05 Wetland Wild Flora (Seasonally Flooded)

Devils Bit Scabious	Red Clover	Red Rattle*
Fleabane*	Selfheal	
Greater Trefoil	Marsh Cinquefoil*	Corn Chamomile*
Hemp Agrimony*	Water Avens	Corn Marigold
Lesser Knapweed	Wild Angelica	Corn Poppy
Marsh Marigold	Wild Valerian*	Corncockle*
Marsh Ragwort	Yellow Flag Iris	Cornflower*
Meadowsweet	Yellow Rattle,	Scented Mayweed
Purple Loosestrife	Water speedwell*	Redshank may be added for very wet soils
Ragged Robin	Sneezewort*	

Note: Marsh Ragwort is not the Common Ragwort noxious weed.
*Denotes a species that is either of diminished national geno-type or specific to only a few sites, or who's habitat is increasingly threatened, or the species is uncommon, rare, becoming rare, is endangered, reintroduced or saved from extinction.

Seed Mixture Specifications:
Total number of seeds per gram: 2450
Native Irish Origin, Wildflower Seed Mixture. EC05
Suitable for soil type: All types of wet soil Clay, Loam, Sand, Heavy Soil, and Peat, as long as it remains wet throughout the year. but not raised Peat Bog.,
Moisture Level: Moist, Very wet or flooded.
pH range: Best between 5.5 - 7.5

Morphology:

Aspect: Sunny, part shade and not Shaded.

Life Cycle: Annual / Biennial / Mostly Perennial.

Height Range: <30cm to >140cm

Flowering Period: Spring to May to September.

Fertility Range: Will grow in very fertile soil to poor.

Wintergreen: No.

The main species which should dominate and persist: Devils Bit Scabious, Fleabane, Greater Trefoil, Hemp Agrimony, Lesser Knapweed, Marsh Marigold, Marsh Ragwort, Meadowsweet, Purple Loosestrife, Ragged Robin, Water Avens, Wild Angelica, Wild Valerian, Yellow Flag Iris, Annual Species: Red Rattle, The annual Redshank is the best nurse crop on wet soils and is added to this mixture, it will not re-grow after the second year.

Biennial Species: Wild Angelica.

Unusual species:

The general public will not be familiar with Devils Bit Scabious, Fleabane, Greater Trefoil, Ragged Robin, Yellow Loosestrife, Red Rattle, Water Avens, Wild Angelica, Wild Valerian, of which only fleabane seem to becoming scarce

Additional species to add to this mixture: From our nursery: Mint, Bittersweet, a climbing shrub, Brooklime, Bugle, Reed Mace & Bulrush (if in stock).

Sowing Specification:

As Normal, roll or rake into surface to keep out of reach from birds.

Once sown this mixture in normal conditions (mainly in early Autumn and late Spring, when the wetland soil dries out) should germinate 6 weeks after sowing, from then on provided the sward is kept open and a 'Thatch' is not allowed develop, species will continue to germinate and emerge, through to the third year.

Up to 40% of all seed should germinate in the first year.

Up to 60% of all species should germinate in 12 months.

Up to 90% of all species should have flowered by the fourth year after sowing.

Late Autumn and early Summer sowings may be slow to emerge, depending on the weather.

Soil Preparation:

Normal, create fine tilt on seed bed,

Optimum Sowing Time:

Spring and August or early September

Sowing Conditions:

Normal, when soil is at its driest. Wetland wildflowers will be difficult to sow due to the nature of the ecotype, seek advice.

Sowing Method:

By hand is recommended, if using seed spreaders be careful to insure the small varieties of seed do not drop to the bottom of the seed spreader and get sown all in the one place. Can be Hydrasown

Seed Sowing Rates:

1.5 grams per metre.

Normal sowing rate 'without added grass seed': 1.5 grams per metre.

High sowing rate 'without added grass seed': Add 3 grams per metre.

Low sowing rate: None.

Performance:

The third year is the critical year to maintain this meadow to restrict the growth of grasses native to the site..

If this mixture is sow with annuals, or contains annuals, they will flower profusely in the first year, provided they are sown before June. They require one cut when finished flowering. In the second year the biennials will also be very colourful. Cut once in late August.

In the third year this meadow mixture will seem to have less flora than the first and second year. Why?

The perennial species are still young, many will only have germinated in the second season, so flowers will be sparse. However, there should be identifiable foliage and some flowers. If not contact us.

In the second and third the native grasses in your soil will have grown and will be emerging so strongly that the meadow will require two cuts, one in Spring and the Second in July or August, the meadow can again be cut in September if the grasses are still growing strong.

When should this meadow be established and require one cut.

In the fourth year the perennials in the mixture should be flowering on many stems and starting to clump and spread, again if the grass is still vigorous cut in spring and in August of the fourth year. However if the perennials are growing strong there will be no need to cut until July, August or September depending on the fertility and wetness of the soil and the species which have grown.

A wildflower meadow should last many years, provided the species established, weeds were controlled and the meadow was cut and the cut material removed and occasional 'Gaps' are created. If not contact DBN.

Persistence if unmanaged: High

Tolerance of Cutting: Moderate

General Cutting Time: End of Summer, but before the soil becomes overly wet.

Specific Cutting Time: Wait 3 weeks until after the last flush of flowers fade away, after seeds set.

Management:

Control weeds, especially Creeping Buttercup. If Creeping Buttercup is present cut this meadow in May in year two. The third year is the critical year to maintain this meadow as scutch grass, creeping thistle, nettle and dock will try to dominate as the growing conditions are ideal for such unwanted species.

A General Description of DBN wildflowers.ie Ecotype Range EC05:

Ecotype seed mixtures are designed to imitate natural ecologies found in specific situations. This wetland mixture could be found in nearly every county in Ireland. It is an idea Ecotype seed mixture for nature conservation. The EC range is not intended as an exact copies of an Irish ecosystem but to represent floras that would otherwise take hundreds of years to develop if 'nature' was left unaided. This range of seed mixture is ideal for those concerned with encouraging wildlife and local biodiversity as the plants will attract species suited to the ecology. If these mixtures are suitable for your situation, they offer good value, contain some of the most exacting and unusual species and if given time, develop into a diverse flora that will persist if properly maintained.

APPENDIX IV

Restoration plan drawings and sections

Figure 1 - Present Site Layout

PLANNING & DEVELOPMENT SECTION
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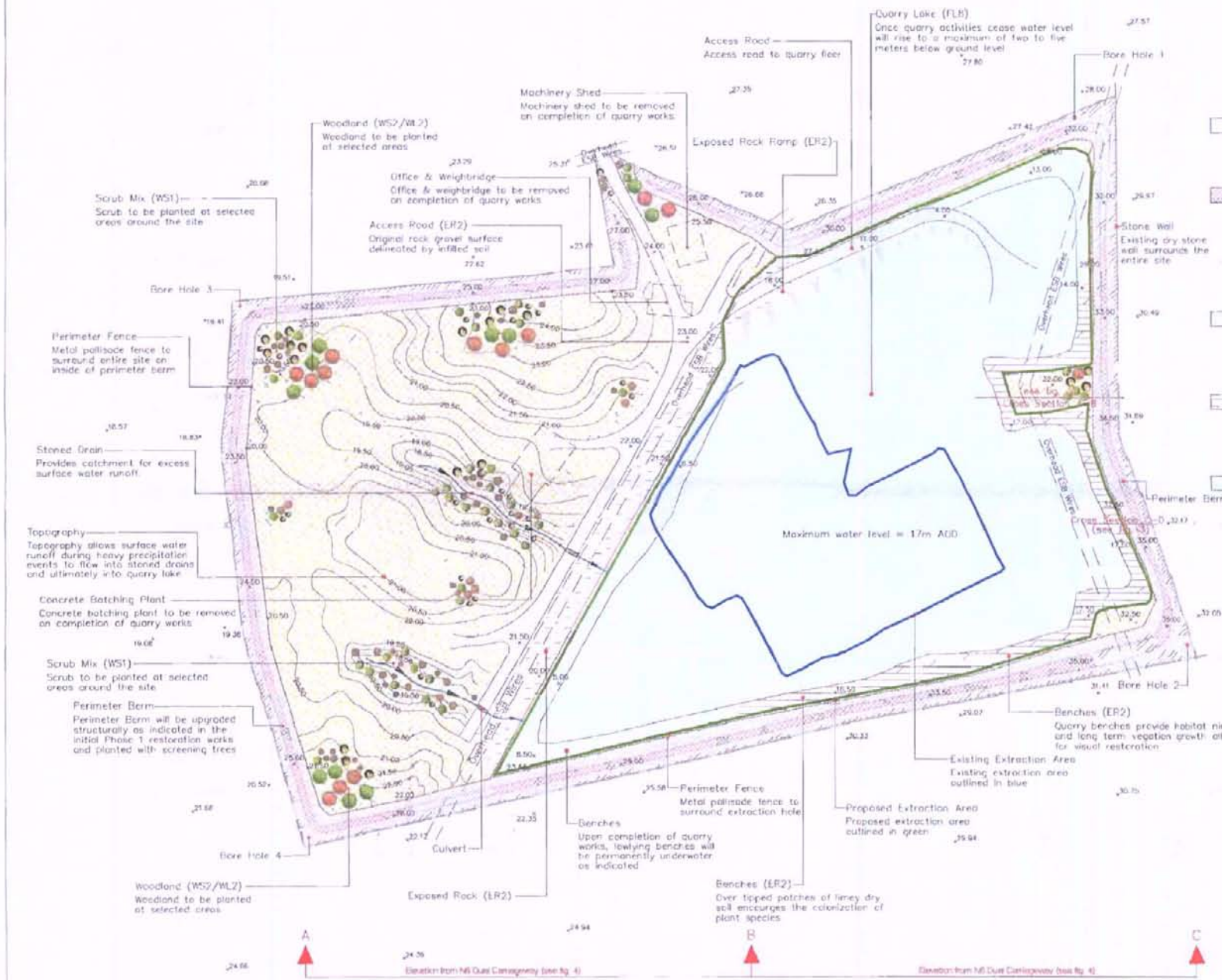
RECEIVED
planning development section
GALWAY COUNTY COUNCIL

NOTES
- All levels are relative to Ordnance Datum (Malin Head)
- 100m sq grid relative to Irish National Grid (IC 1975)
- Contours are at 1.0 meter intervals

Control Surveys
land and building surveyors
THE IRISH INSTITUTION OF SURVEYORS No. 562
6 Crestwood, Kilteragh, Dooradoyle, Limerick. 061/495 8
Tel: 087 2659112 email: cian@controlsurveys.ie
website: www.controlsurveys.ie

- Topographical Surveys
- Measured Building Surveys
- Legal Mapping
- As Built Surveys
- GPS Surveys
- Setting Out

Figure 2 - Proposed Restoration Plan Layout



KEY:

Grassland & Wildflower Planting Mixes (GA1 & GS1)

Native Origin Irish Wildflower and Grass Seed Mix. Three options for three different soil types are provide to accommodate each potential soil type which may be imported, they are;

MM05 – Wildflower & Grasses Seed mixture MM05 for soil with high peat content

MM08 – Wildflower and Grasses Seed mixture for Moist Limy Soil (alkaline ph >7)

MM09 Wild Flora for Dry Limy Soil (alkaline ph >7)

Exposed Rock Wildflower Planting Mix (ER2)

Native Origin Irish Wildflow Seed Mix, Product Name:

MM09 – Wild Flora for Dry Limy Soil

Woodland Planting Mix (WS2/WL2)

Hazel	Ash (NWS)
Birch (NWS)	Alder (NWS)
Downy Birch (NWS)	Blackthorn (NWS)
Holly (NWS)	Whitethorn
Goat Willows (NWS)	Gorse
Scots Pine (NWS)	Dog Ro

Scrub Planting Mix (WS1)

Hawthorn	Bramble
Blackthorn	Willows
Plus EC04	

Seasonally Flooded Exposed Rock Wildflower Planting Mix (ER2 & FLB)

Seasonally flooded quarry bench mix, Native Origin Irish Wildflower Seed Mix. Product Name:

EC05 Wetland Wild Flora (Seasonally Flooded)

Deep Water Planting Mix (ER2 & FLB)

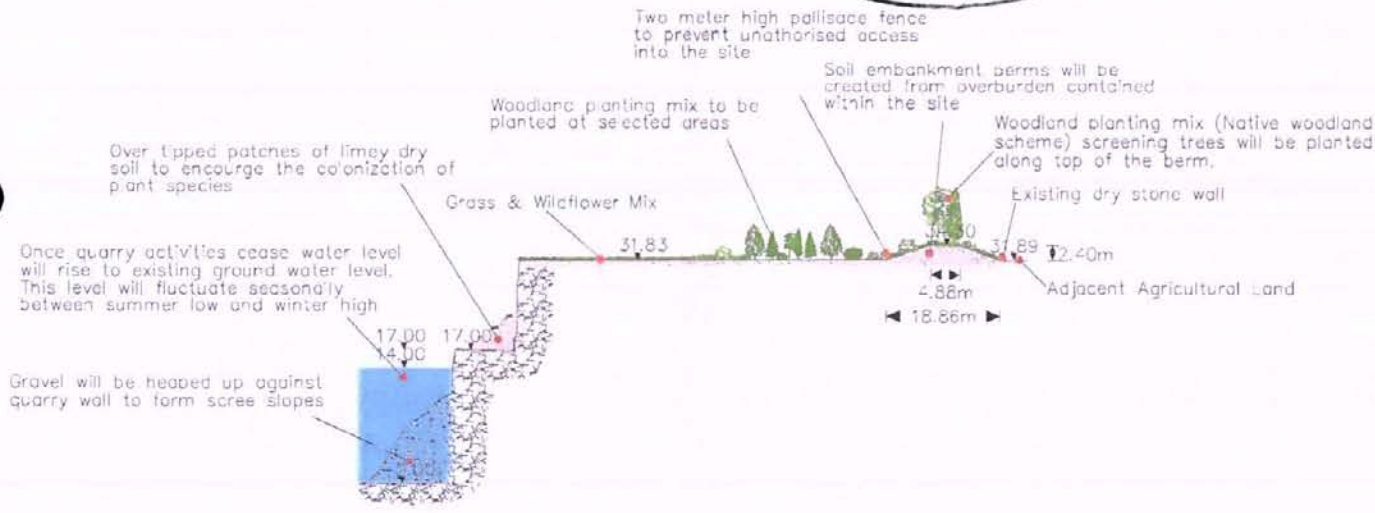
Pondweed	Yellow Water Lily
White Water Lily	

NOTES:

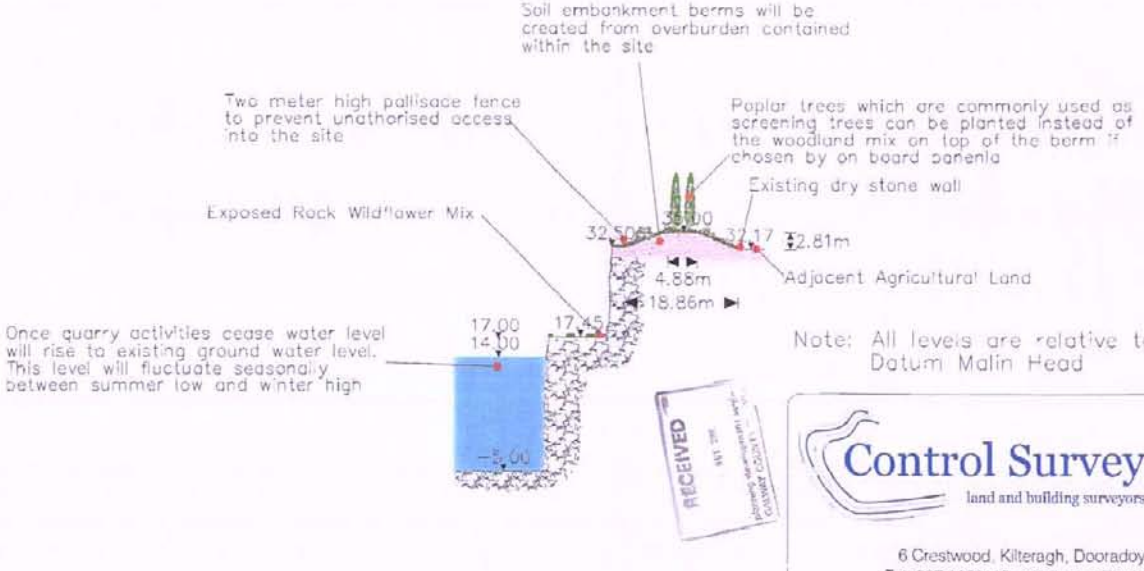
- All levels are relative to Ordnance Datum (Malin Head)
- 100m sq grid relative to Irish National Grid (IG 1975)
- Contours are at 0.5 metre intervals

Figure 3 - Sections of Final Quarry Faces

Cross Section A–B
Locaton of cross-section can be seen on
Figure 2 – Proposed Restoration Plan Layout



Cross Section C–D
Locaton of cross-section can be seen on
Figure 2 – Proposed Restoration Plan Layout



Note: All levels are relative to Ordnance Datum Malin Head

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land and building surveyors
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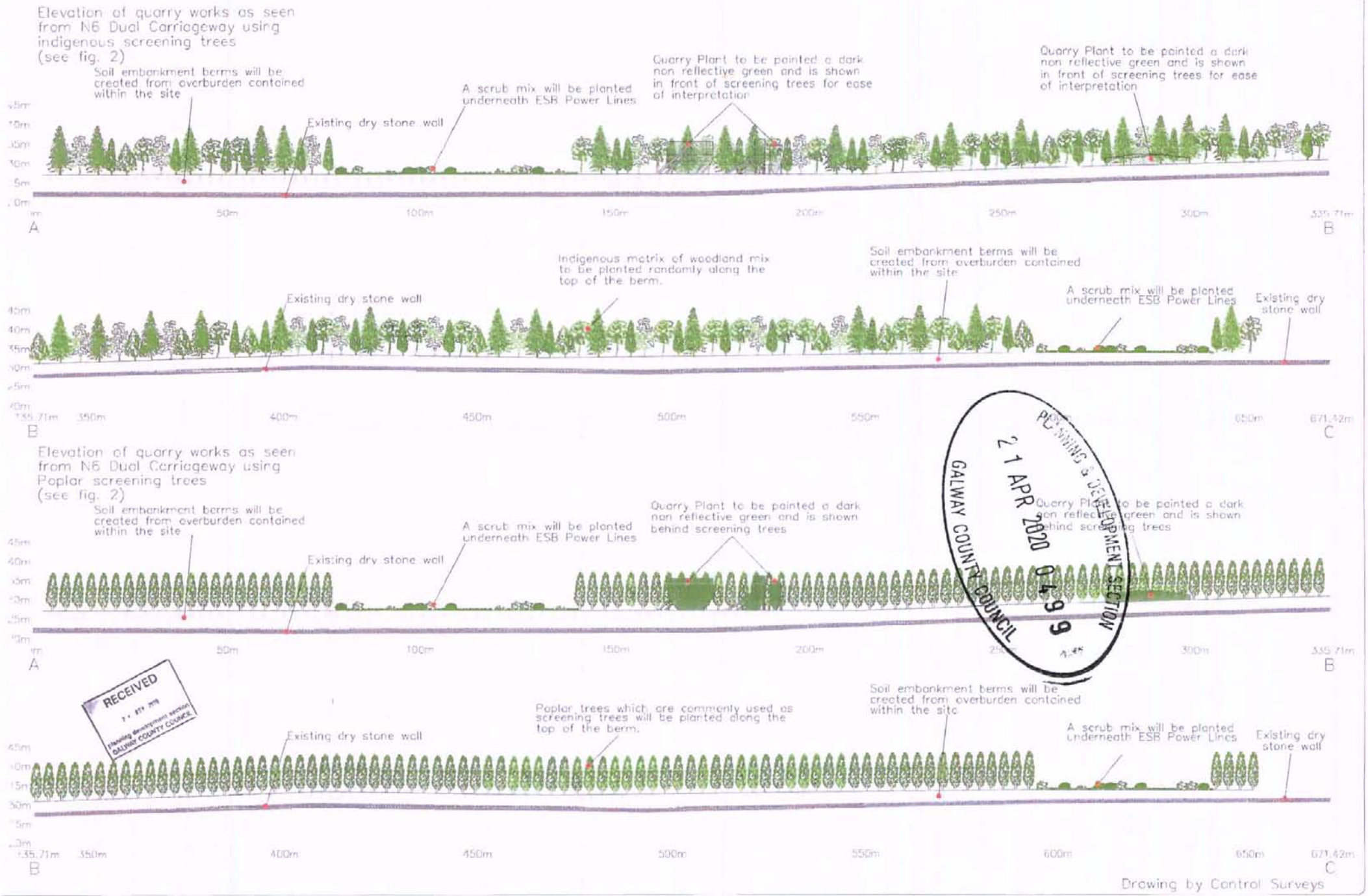
Tel: 087 2659112 email: cian@controlsurveys.ie
website: www.controlsurveys.ie

- Topographical Surveys
- Measured Building Surveys
- Legal Mapping
- As Built Surveys
- GPS Surveys
- Setting Out

Figure 4 - Visual Screening and Elevations from N6



CONFIDENTIAL APPENDIX 5-1

FIGURE 5.5 LOCATION OF PEREGRINE FALCON NEST

Map Legend

- Site Boundary
- Proposed Expansion Phases
  - Phase 1
  - Phase 2
  - Phase 3
- Existing Extraction Area

PLANNING & DEVELOPMENT SECTION
21 APR 2020 0499
GALWAY COUNTY COUNCIL

N

Figure 5.5

Drawing Title: Expansion Phasing

Project Title: Coshla Quarry Extension

Drawn By	Checked By
TJB	MW
Project No.	Drawing No.
180918	
Scale	Date
1:6250	22.01.20

MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email:info@mkoireland.ie
Website: www.mkoireland.ie

APPENDIX 6-2

WELL DRILLING LOGS

Patrick Briody & Sons Ltd

DRILLING LOG

AQUADRILL SERVICES — **Well Drilling & Site Investigation Contractors**

The Grove,
Rathangan, Co. Kildare.
Tel (045) 524360
Fax (045) 524785
e-mail: info@briodydrilling.com

Consultant/Engineer.....

Client. Coshla Quarries Ltd

Borehole Reference No. BH1 Sheet 1 of 1

Borehole Location. Barrettspark Townland, Caherdavin, Co. Galway 0501

Date of Drilling	Depth (from - to) Mtrs/Ft.	Actual Drilling Diametre	Drilling Conditions / Water Strike
9th/7/07	Mobilise to site & set-up		
	0 - 12 ft	10"	Gravel / weathered rock
	12 - 20 ft	10"	Competent limestone rock
	Supply + install 20ft		6" dia m/s casing (0-20ft)
	20 - 140 ft	6"	Grey limestone rock
	140ft - 141 ft	6"	small fracture, est 300 gph
	141 ft - 300	6"	grey limestone rock
	300 - 360 ft	6"	Limestone with Calcite Chips, est +500 gph
	Instructed to drill		to 460ft
	360 - 420 ft	6"	Continuing limestone with some sand content and calcite chips + 200 gph
	420 - 460	6"	limestone less sand content
	Supply + fit 0-460ft		5" manually slotted plastic sleeving

Total Depth of Well. 460ft

Estimated Yield. 1000 gph

Depth to Rock.....

Steel Casing Installed. 6" steel 0-20ft / 5" plastic

P.V.C. Casing/Screen Installed 5" plastic 0-460ft

Other Remarks.....

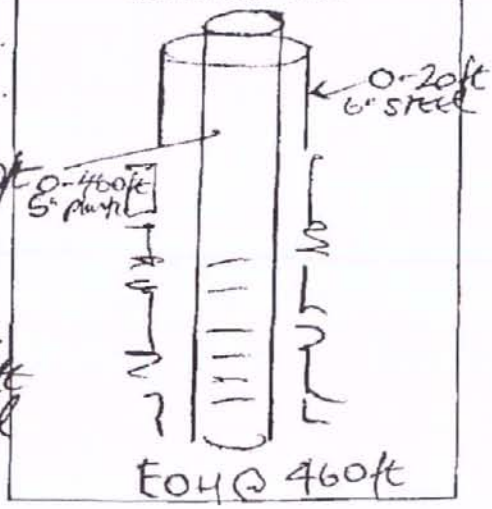
Hinged lockable lid fitted on protruding 6" steel

Samples retrieved bagged & marked every 2ft

Lead Driller. Eric Briody Drilling Rig. Reichdrill

Engineer Approval.....

Schematic View



Patrick Briody & Sons Ltd.

AQUADRILL SERVICES — **Well Drilling & Site Investigation Contractors**

2206 7958

DRILLING LOG

The Grove,
Rathangan, Co. Kildare.
Tel (045) 524360
Fax (045) 524785
e-mail: info@briodydrilling.com

Consultant/Engineer.....

Client. Coshla Quarries Ltd

Borehole Reference No. B414 Sheet 1 of 1

Borehole Location. Barrettspark Townland, Carrowmore, Co. Galway 0504

Date of Drilling	Dapth (from - to) Mtrs/Ft.	Actual Drilling Diametre	Drilling Conditions / Water Strike
9/7/09	0 - 26ft	10"	Gravel/weathered rock
	26-28 ft	10"	Limestone, competent rock
	Supply + fit	28 ft	6" Steel casing
	28 - 50 ft	6"	Competent limestone
	50 ft - 60ft	6"	broken rock, brown clay layer, some wter 40gph
	60 - 100ft	6"	Good competent rock
	100 - 120ft	6"	Broken rock, brown clay 400 gph, water strike
	120 - 140ft	6"	Additional wter 100gph broken rock, clay band
	140 - 180ft	6"	Competent rock
	180ft 200	6"	Weathered rock + 200gph
	200 - 280	6"	Competent limestone
	280 - 300		Weathered rock, clay + 100gph
	300 - 330	6"	Competent rock.

Supply + fit 330ft 5" manually slotted plastic

PLANNING & DEVELOPMENT SECTION
21 APR 2020
0499
GALWAY COUNTY COUNCIL

Total Depth of Well.....

Estimated Yield. 800 gph

Depth to Rock. 28ft

Steel Casing Installed. 28ft - 6" Steel

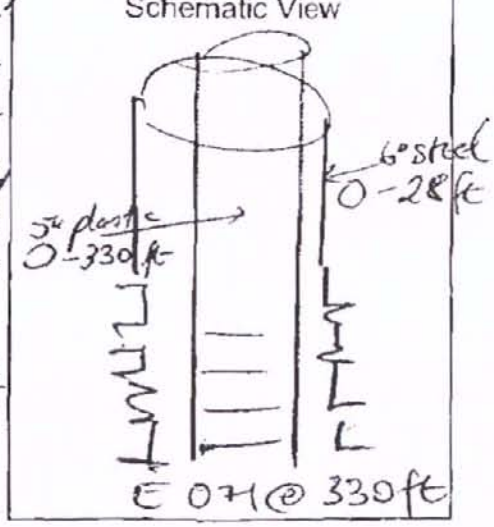
P.V.C. Casing/Screen Installed. 0 - 330ft 5" Slotted plastic

Other Remarks.....
Plunged lockable lid fitted on Protruding 6" steel liner.
Samples retrieved, bagged & marked every 20ft

Lead Driller..... Drilling Rig.....

Engineer Approval.....

Schematic View



Patrick Briody & Sons Ltd.

DRILLING LOG

AQUADRILL SERVICES — **Well Drilling & Site Investigation Contractors**

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Rathangan, Co. Kildare.
Tel (045) 524360
Fax (045) 524785
e-mail: info@briodydrilling.com

Consultant/Engineer.....

Client Coshla Quarries Ltd

Borehole Reference No. BH3 Sheet 1 of 1

Borehole Location Barrettspark Townland, Carrarmore, Co. Galway 0503

Date of Drilling	Depth (from - to) Mtrs/Ft.	Actual Drilling Diametre	Drilling Conditions / Water Strike
9/7/09	0 - 8ft	10"	broken Stone
	8 - 20ft	10"	weathered rock
	Supply 1ft	20ft 6"	m/s Casing 0-20ft
	NOTE! Some water on		top of rock - 10 gph
	20 - 160ft	6"	Competent limestone
	160 - 170ft	6"	Small water, est 20gph
	170 - 330		Competent and consistent solid limestone - No increase in water yield
	Supply 1ft	0-330ft	5" plastic Screened Manually slotted.

Total Depth of Well 330ft

Estimated Yield 30 gph

Depth to Rock 20ft

Steel Casing Installed 6" steel 0-20ft

P.V.C. Casing/Screen Installed 5" plastic 0-330ft

Other Remarks

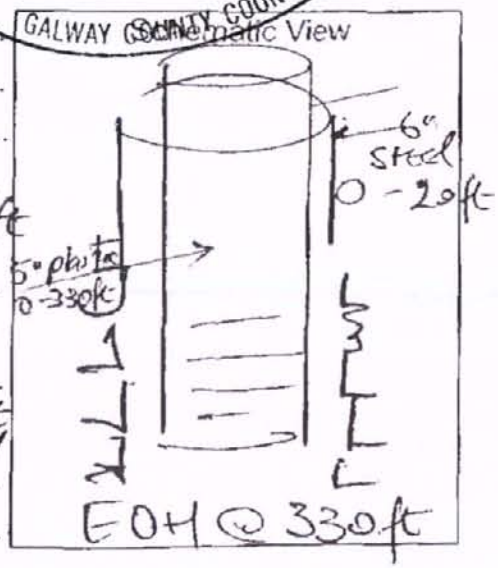
Hinged lockable lid fitted on protruding 6" steel

Samples Retrievel bagged & marked every 2ft

Lead Driller Willie Cunningham Drilling Rig Reichdrill

Engineer Approval.....

Schematic View



Patrick Briody & Sons Ltd.

DRILLING LOG

AQUADRILL SERVICES **Well Drilling & Site Investigation Contractors**

The Grove,
Rathangan, Co. Kildare.
Tel (045) 524360
Fax (045) 524785
e-mail: info@briodydrilling.com

Consultant/Engineer.....

Client Coshla Quarries Ltd

Borehole Reference No. BH2 Sheet 1 of 1

Borehole Location Barrettspark Townland, Carrannmore, Co. Galway 0502

Date of Drilling	Depth (from - to) Mtrs/Ft.	Actual Drilling Diametre	Drilling Conditions / Water Strike
9/7/07	0 - 20ft	10"	Gravel / sand layer
	20 - 40ft	10"	Gravel / brown clay layers
	40 - 42ft	10"	Weathered rock
	Supply + fit	6" dia	M/S Casing 0 - 42ft.
	42 - 140ft	6"	Competent Grey limestone
	140 - 160ft	6"	Weathered limestone
			Water Strike 400 gph Some
			brown clay.
	160 - 180	6"	Limestone rock with Calcite
	180 - 335	6"	Continuing through
			harder bands of limestone
			Small increase in water
			@ 300ft + 100 gph
	Supply & fit 0 - 330ft		5" manually slotted
	plastic sleeving		

Total Depth of Well 330ft

Estimated Yield 500 gph

Depth to Rock 40ft

Steel Casing Installed 0 - 40ft 6" Steel

P.V.C. Casing/Screen Installed 0 - 330ft 5" plastic

Other Remarks

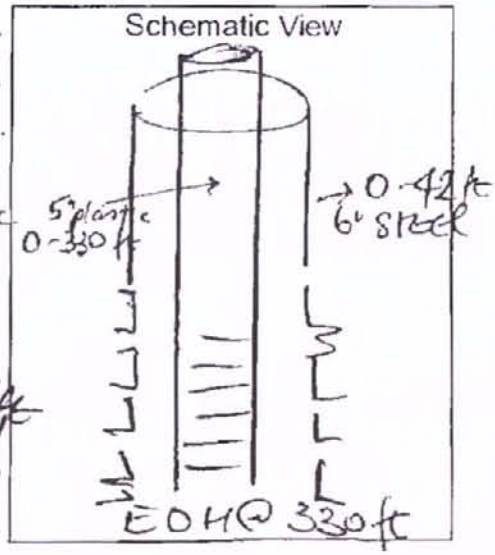
Hinged lockable lid fitted on protruding 6" steel

Samples retrieved, bagged & marked every 2ft

Lead Driller Willie Cunningham Drilling Rig Reichdrill

Engineer Approval

Schematic View



Patrick Briody & Sons Ltd.

DRILLING LOG

AQUADRILL SERVICES **Well Drilling & Site Investigation Contractors**

The Grove,
Rathangan, Co. Kildare.
Tel (045) 524360
Fax (045) 524785
e-mail: info@briodydrilling.com

Consultant/Engineer.....

Client Cosh la Quarries Ltd

Borehole Reference No. BH5 Sheet 1 of 1

Borehole Location. Barrettspark Townland, Carranmore, Co. Galway 0505

Date of Drilling	Depth (from - to) Mtrs/Ft.	Actual Drilling Diametre	Drilling Conditions / Water Strike
16/7/07	0 - 2ft	10"	Clay, Stone
	2ft - 20ft	10"	weathered rock
	Supply + install	20ft	6" steel casing
	20 - 80ft	6"	Competent limestone
	80 - 82ft	6"	Clayband
	82 - 140ft	6"	Competent Clayband
	140ft - 180ft	6"	Weathered rock small water 40 gph
	180ft - 320	6"	Competent rock Small additional water strike @ 320ft + 40 gph
	Supply + fit plastic	0 - 320ft	5" manually slotted

Total Depth of Well 320 ft

Estimated Yield 80 gph

Depth to Rock 20ft

Steel Casing Installed 6" Steel 0-20ft

P.V.C. Casing/Screen Installed 0-320ft

Other Remarks

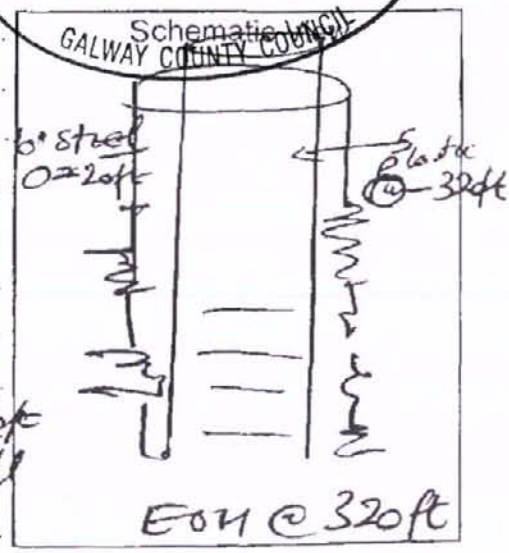
Hinged lockable lid fitted on protruding 6" Steel

Samples retrieved logged & labelled every 2ft

Lead Driller ERIC Briody Drilling Rig Deuchdeil

Engineer Approval.....

Schematic



APPENDIX 6-2

QUARRY FLOOR DRILLING LOGS

Coshla Quarry, Co. Galway
Appendix 6.2: Investigation Drilling Logs

BH ID	Easting	Northing	Drilling Observations
EH01	143005	228762	Shallow surface water inflows. Dry drilling in good rock below
EH02	143009	228750	Shallow surface water inflows. Dry drilling in good rock below. Soft section between 15 and 16.5m
EH03	142994	228736	Rock at surface. Dry hole, competent limestone
EH04	143000	228718	Rock at surface. Dry hole, competent limestone
EH05	142983	228670	Rock at surface. Dry hole, competent limestone
EH06	142989	228696	Rock at surface. Dry hole, competent limestone
EH07	143037	228722	Slighty weathered between 20 and 22m, no measureable groundwater inflows. Rest of hole competent limestone
EH08	143032	228648	Rock at surface. Dry hole, competent limestone
EH09	143040	228681	Rock at surface. Dry hole, competent limestone
EH10	143022	228667	Orange/brown, soft limestone to 18m (dusty). Competent limestone below.
EH11	143017	228624	Orange/brown, soft limestone to 18m (dusty). Competent limestone below.
EH12	143019	228611	Slightly weathered rock between 5 and 7.5m, no measureable gw inflows. Good rock below.
EH13	143032	228610	Rock at surface. Dry hole, competent limestone
EH14	143021	228593	Rock at surface. Dry hole, competent limestone
EH15	143017	228577	Rock at surface. Dry hole, competent limestone
EH16	143027	228549	Rock at surface. Dry hole, competent limestone
EH17	142998	228530	Rock at surface. Dry hole, competent limestone
EH18	142977	228560	Rock at surface. Dry hole, competent limestone

APPENDIX 7-1

LABORATORY REPORTS

Table 1 of Appendix 7.1
Coshla Quarry, Athrenry. Co Galway
Groundwater Quality Data

Sample Date	Units	BH1	BH2	BH4	Drinking Water Regs (S.I. 122 of 2014)	Groundwater Regs (S.I. 9 of 2010)	EPA Interim Guideline Values*
Date		**22/11/2018**	**22/11/2018**	**22/11/2018**			
Parameters							
Ammonia	mg/l	0.04	0.03	0.03	0.3	0.065	0.15
Calcium	mg/l	143	102	107	-	-	200
Chloride	mg/l	22.5	21.5	28	250	187.5	30
Electrical Conductivity (field parameter)	uS/cm	690	580	610	2500	1875	1000
Iron	mg/l	<0.002	<0.002	<0.002	0.2	-	0.2
Magnesium	mg/l	13.4	4.29	10.6	-	-	50
Manganese	mg/l	0.00513	<0.0005	<0.0005	0.05	-	0.05
Nitrate NO_2	mg/l	<4.43	7.97	***40.3***	50	37.5	25
Nitrite	mg/l	<0.01	<0.01	<0.01	0.5	0.375	0.2
Total Nitrogen	mg/l	<0.1	2.9	10.1			
pH (field parameter)	ph (units)	7.3	7.4	7.4	-	-	>=6.5 and <=9.5
Ortho Phosphate as P	mg/l	<0.02	<0.02	<0.02	-	-	0.03
Potassium	mg/l	0.952	1.06	4.13	-	-	5
Sodium	mg/l	11.9	11.6	12.2	200	150	150
Sulphate	mg/l	14.33	<5	52.91	250	187.5	200
Turbidity	NTU	1.68	2.25	0.16	NAC	-	-
Lead	µg/l	5	5	5	10	18.75	10
Cadmium	µg/l	<0.4	<0.4	<0.4	5	3.75	5
Zinc	µg/L	4.6	2	2	-	-	100
Copper	mg/L	<0.002	<0.002	<0.002	2	1.5	0.03
Nickel	µg/L	**158**	2	**21.8**	20	15	20
C10 - C12	µg/l	<5	<5	<5	-	-	-
C10 - C40	µg/l	<50	<50	<50	-	-	10
C12 - C16	µg/L	<5	<5	<5	-	-	-
C16 - C35	µg/l	<30	<30	<30	-	-	-
C35 - C40	µg/l	<10	<10	<10	-	-	-

* Towards Setting Guideline Values for the Protection of Groundwater in Ireland - Interim Report (EPA, 2003)
NAC - No abnormal change
Bold and italics - exceeds GW Regs (SI 9 of 2010) TV value
Bold Underlined - exceeds Drinking Water Reg (SI 122 of 2014) paramter value
Bold - exceeds both GW and DW Regs

APPENDIX 8-1

ENVIRONMENTAL AUDIT REPORT

Irish Concrete Federation
8 Newlands Business Park, Naas Road, Clondalkin, Dublin 22, D22 R2F8
T: 01 464 0082 F: 01 464 0087 E: info@irishconcrete.ie
www.irishconcrete.ie

Mr. Martin Collins,
Quarry Manager,
Coshla Quarries Ltd.,
Barretts Park,
Oranmore,
County Galway

28th February 2019

Re: Environmental Audit and Report per Condition 22 of PL 07.235821 and Environmental Monitoring and Management Proposals as required by that permission

Dear Martin,

Further to my audit of the Barretts Park facilities and records, I attach the ICF Environmental Audit Checklist completed on 18th January 2019, the Environmental Management Plan for 2019 and, hereunder, a summary report on my findings and other reporting as required for compliance with Condition 22 and other conditions of PL 07.235821, the An Bord Pleanala decision relating to the site.

Condition 22 (a) of PL 07.235821
(i) Traffic Records
I wish to confirm that I have examined the electronic management accounts system and weighbridge reports held by Coshla Quarries, again for the key months June to September 2018. As before, the product breakdown and volume of tonnage is highly confidential but has been made available for this audit function only; the records are available for inspection by Galway County Council upon request.

I confirm that the maximum traffic threshold, per Condition 3(a), does not appear to have been exceeded in any instance during the periods inspected (weighbridge daily reports inspected with days chosen randomly) and average HGV movements are reported as approximately two-thirds of the permitted movements, based on the monthly cumulative reports made available to me.

(ii) Topographical Survey
An updated topographical survey is being prepared and submitted separately.

(iii) Summary of Environmental Monitoring
Management of blasting, environmental noise and water emissions is managed in an acceptable manner. There are no real concerns that emission limits are in danger of being exceeded.

Blast PPV levels were monitored at 2 locations (Duggans and C&F) for each of 8 blasts in 2018, with one monitor not triggering on 2 occasions. Peak particle velocities were at an acceptable level, comfortably within the 12 PPV limit (4.45 max), and 125 dB overpressure limit (124 max). All reports were available and reviewed, with most results well within the ELVs. Blasting emissions are not an issue at this site given the distance to the neighbours and depth of working.

A waste water discharge licence was issued by GCC in August 13 to provide for the water discharge to ground. A significant amount of testing was carried out in 2018, borehole water quality is good and average results on the lagoon (pre-discharge) water are good. With a ground discharge, it is the borehole results that

are most important. Per recommendation of last year, pH testing of the lagoon water was included at intervals 2018.

Noise monitoring was carried out quarterly at 3 locations by BHP Lab. in 2018; both NSL1 and NSL4 recording the maximum ELV (53dB(A) – no tonal character) on separate occasions and both had 52 on one occasion. I repeat the 2013 recommendation to seek agreement with Galway County Council to reduce monitoring to twice per annum, per An Bord Pleanala standard condition in this area.

(iv) Summary of Dust Monitoring
Dust monitoring takes place every month of the year at 5 locations. As crushing continues to take place at a bench level lower than the general quarry ground level, there should never be an issue with dust emissions, and mitigations are in place, primarily for H&S purposes, to employ a water bowser to spray areas when and where dust suddenly increases in dry weather in order to ensure visibility within the quarry for traffic. If emissions are ever likely to be raised, it would be only in periods of dry weather, and where work was progressing in close proximity to a single dust monitoring location.

This site has a history of monitoring pots being tampered with, and a small number of results in 2018 (2) cannot readily be explained by any other cause. A summary of dust results available is attached (12 months). It shows an unexplainable hike in very significant threshold exceedances at D5 in July, really at a very elevated level on that single occasion, which is not really credible. While the D5 location is located near the access road is always likely to register relatively high dust deposition due to traffic generated dust (non-processing activity) and was above the threshold the previous month, values of >1,000 would never arise naturally, implying some tampering or contamination may have occurred. There was also an unexplained high result (746) at D2 which is otherwise recording quite low levels; as there is no pattern to this, some single discrete incident must have been present pushing the average up at this location but still well within the standard threshold.

Overall, ignoring obvious single outlier this year (> 1,000), and including the high D2 once-off result, the averages for each location are well within specification, albeit that D5 is above 300. However, it does support a finding that when an outlier occurs, some human factor is at play.

As previously recommended, attention must be given on a monthly basis to evidence of tampering and otherwise to investigate when the ELV threshold is exceeded for the reason(s) why, given the location of the extraction and processing is located at a lower bench level.

It is recommended that the planning authority is written to seeking that D5 is no longer used and that a location in that general area but within the site boundary is used so that (i) interference by third parties might be minimised and (ii) a more representative dust level be recorded along that part of the boundary. As before, the AER reports of previous years should be referred to for further reading on the history of dust monitoring results at this site.

(iv) Complaints
It is noted that there were no complaints directly to Coshla Quarries in 2018. There is an ongoing issue with one neighbour who generally and consistently complains directly to the Council and whose direct complaints to the operator have been treated as vexatious and went unrecorded to date. This has escalated to legal proceedings and the matter must be treated here as sub-judice.

(v) Landscaping
Condition 10 required planting and landscaping works and these works were carried out in late 2012 in line with the management program developed at that time and the site continues maintenance as needed.

(vi) Continual Improvement in Environmental Performance
This site remains in good shape and substantially compliant every month. Concerns have been identified in the EMP 2019 for the site manager's implementation in 2019, and implementation will ensure problems are identified in time, rather that retrospectively at audit stage.

Condition 22 (b) of PL 07.235821
On the basis of the groundwater monitoring results reviewed (quarterly at 4 boreholes), there does not appear to have been any incidents of groundwater pollution as a result of quarry activities during 2018.

Conclusions
Reporting and review procedures have been improved again and I regard this as an actively managed site, with all of the necessary infrastructural elements and procedures in place. Given the site scale and the nature of extraction being below ground level and significantly below higher perimeter berms, environmental issues of any significance should not routinely arise, as long as the existing water management practices are followed.

Yours sincerely,

William Smyth FIEI
Senior Manager – Regulatory Compliance

Encl. Environmental Audit Checklist 18th January 2019
Environmental Management Plan 2019
Summary of Dust Monitoring Results 2018

APPENDIX 9-1

CALIBRATION CERTIFICATES

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [x] Andy Moorhouse [ ]
Gary Phillips [ ] Danny McCaul [ ]

acoustic calibration laboratory
The University of Salford, Salford, Greater Manchester, M5 4WT, UK
http://www.acoustics.salford.ac.uk
t: 0161 295 3030/0161 295 3319 f: 0161 295 4456 e: c.lomax1@salford.ac.uk

UKAS CALIBRATION
0801

University of Salford MANCHESTER

Certificate Number: 03377/2 Date of Issue: 22 August 2017

PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006

FOR:	AWN Consulting Limited The Tecpro Building Clonshaugh Business and Technology Park Dublin
FOR THE ATTENTION OF:	Ronan Murphy
PERIODIC TEST DATE:	22/08/2017
TEST PROCEDURE:	CTP12 (Laboratory Manual)

Sound Level Meter Details

Manufacturer	Bruel & Kjaer	
Model	2250	
Serial number	2818080	
Class	1	
Hardware version	4.0	Software version: BZ7222 Version 4.7.2

Associated Items	Microphone	Preamplifier	Calibrator
Manu	Bruel & Kjaer	Bruel & Kjaer	Bruel & Kjaer
Model	4189	ZC 0032	4231
Serial Number	2804243	16943	2205805
Calibrator Adaptor	-	-	UC0210

Test Engineer (initial): GP Name: Gary Phillips

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Certificate Number: 03377/2 Date of Issue: 22 August 2017

Procedures from IEC 61672-3: 2006 and TPS 49 Edition 2 June 2009 were used to perform the periodic tests.

The manufacturer's instruction manual was marked as follows: B&K 2250 BE 1712-15 April 2007 from hardware version 1.1.

Adjustment data used to adjust the sound levels indicated in response to the application of a multi-frequency sound calibrator to sound levels equivalent to those that would be indicated in response to plane, progressive sound waves were obtained from the manufacturer's instruction manual referred to in this certificate. The sound level meter calibration check frequency is 1000 Hz, the reference sound pressure level is 94 dB. As this instrument only has a single range, this range is the reference level range.

The environmental conditions in the laboratory at the start of the test were:
Static pressure 101.311 kPa ± 0.017 kPa, air temperature 21.8 °C ± 0.3 °C, relative humidity 61.8 % ± 1.9%.

The initial response of the instrument to application of the associated sound calibrator was 94.0 dB (C). The instrument was then adjusted to indicate 93.9 dB (C). This indication was obtained from the calibration certificate of the calibrator, 09473 and information in the manufacturer's instruction manual specified in this certificate, when the instrument is configured as follows; Input: Top socket, Transducer: 4189 (2804243), Sound Field Correction: Free-field, Windscreen Auto Detect: Off, Windscreen Correction: None. The instrument was calibrated without a windshield. Consult manufacturer's instructions if using a windshield.

With the microphone installed the level of self-generated noise was:

A: 17.0 dB*

* Under-range indicated on instrument display.

With the microphone replaced by the electrical input device specified in the manufacturer's instruction manual, the levels of self-generated noise were:

A: 12.8 dB*
B: 11.8 dB*
C: 13.1 dB*
$Z_{LF\ normal}$: 18.2 dB*
$Z_{LF\ extended}$: 22.6 dB*

* Under-range indicated on instrument display.

The environmental conditions in the laboratory at the end of the test were:
Static pressure 101.173 kPa ± 0.017 kPa, air temperature 21.0 °C ± 0.3 °C, relative humidity 36.4 % ± 1.9%.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

Certificate Number: 03377/2 Date of Issue: 22 August 2017

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

The microphone corrections applied as specified in 12.6 of IEC 61672-3:2006 were obtained from a frequency response measured by this Laboratory using the electrostatic actuator method. This response in isolation is not covered by our UKAS accreditation.

Instruments used in the verification procedure were traceable to *National Standards*. The multi-frequency calibrator method was employed in the acoustical tests of a frequency weighting.

The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

APPENDIX 9-2

GLOSSARY OF NOISE RELATED TERMS

GLOSSARY OF NOISE/VIBRATION TERMINOLOGY

Ambient noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
Background noise	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 (LAF90,T).
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB(A)	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'-weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hertz (Hz)	The unit of sound frequency in cycles per second.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the LAeq value is to either the LAF10 or LAF90 value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AN}	The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{A90} Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

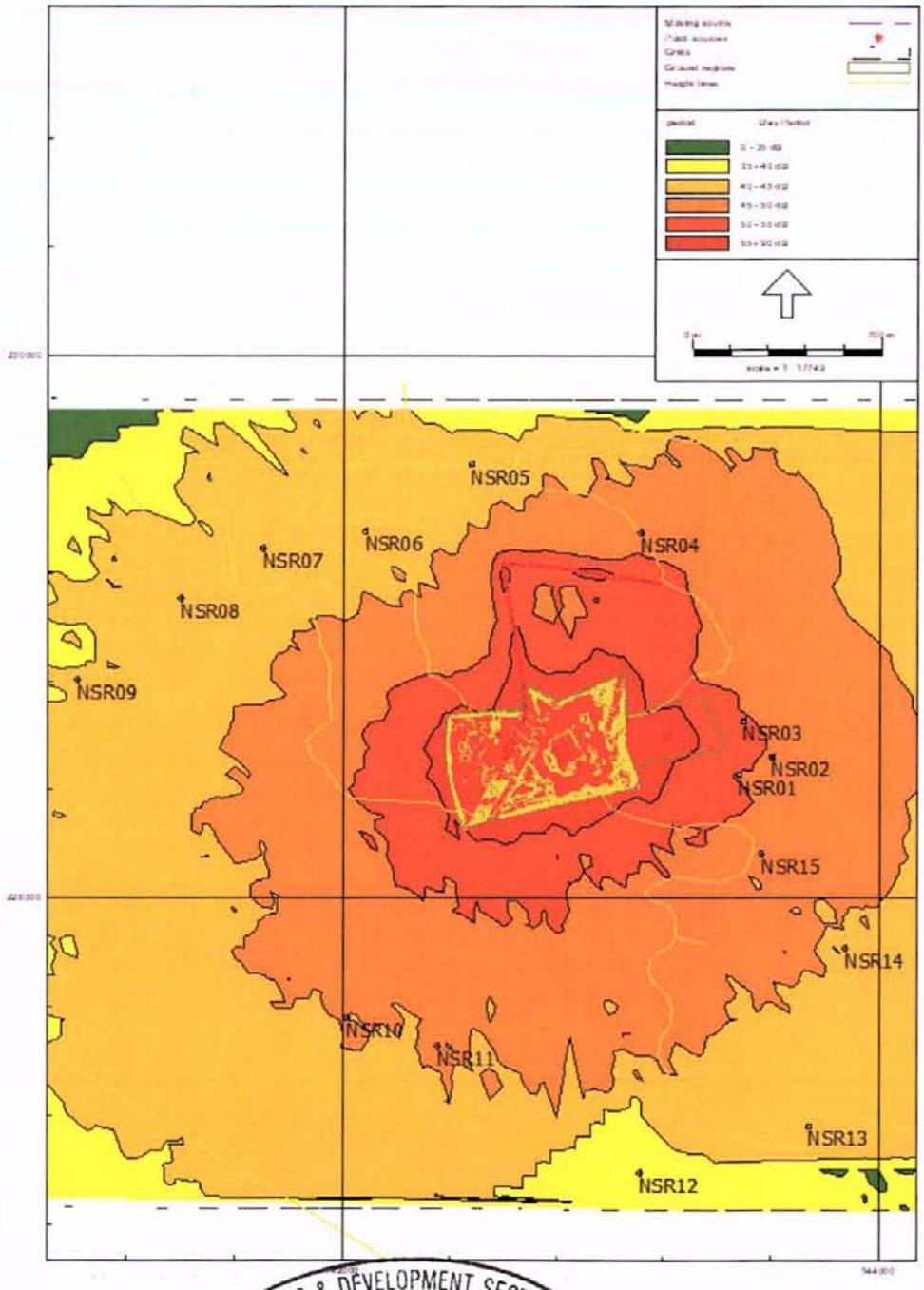
L_{A10} Refers to those A-weighted noise levels in the upper 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting.

L_{AFmax} is the instantaneous fast time weighted maximum sound level measured during the sample period.

L_{AFmin} is the instantaneous fast time weighted minimum sound level measured during the sample period.

APPENDIX 9-3

NOISE CONTOUR PLOT



APPENDIX 11-1

PHOTOGRAPHIC RECORD OF THE DEVELOPMENT SITE

Plate 1: Entrance to the existing quarry from the north looking south.

Plate 2: View from the north of the existing quarry looking WSW.

Plate 3: Existing quarry pit looking NNW.

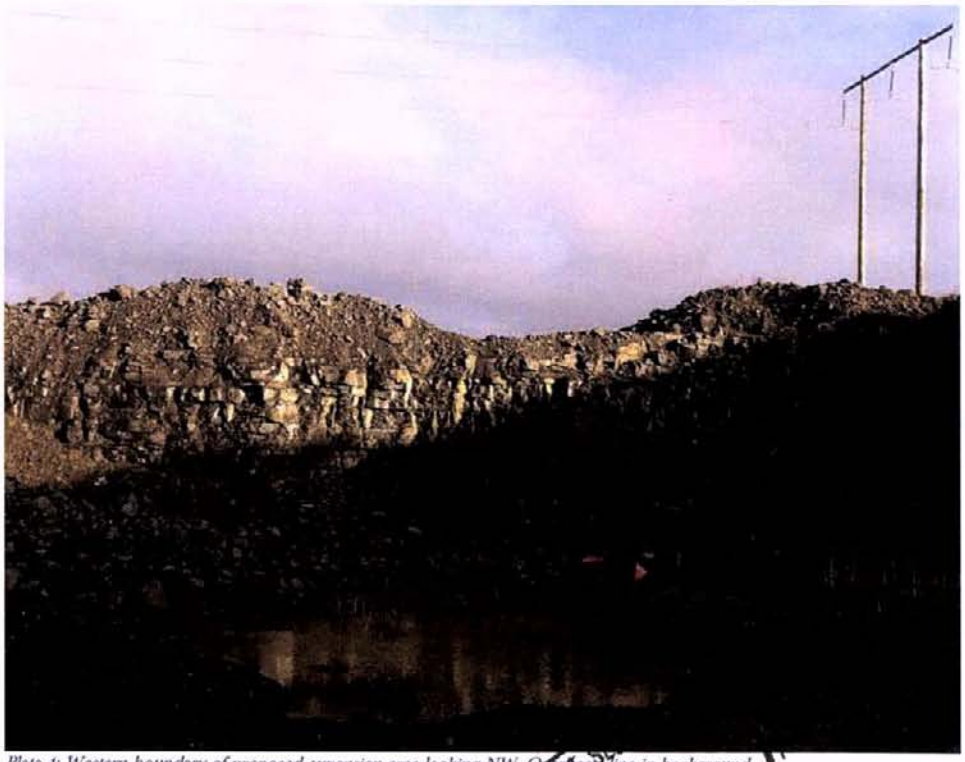


Plate 4: Western boundary of proposed expansion area looking NW. Overhead line in background.

Plate 5: Eastern site boundary marked by trees. Ground reduced to bedrock.

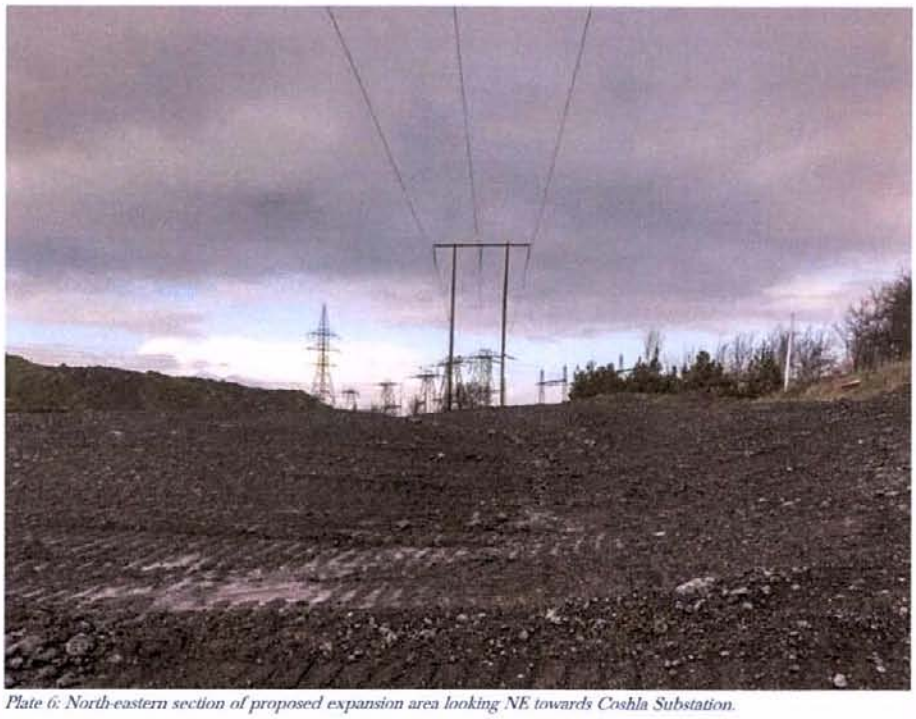


Plate 6: North-eastern section of proposed expansion area looking NE towards Coshla Substation.

Plate 7: View from NE section of expansion area looking WSW, note area reduced to natural horizons and spoil heaps in background.

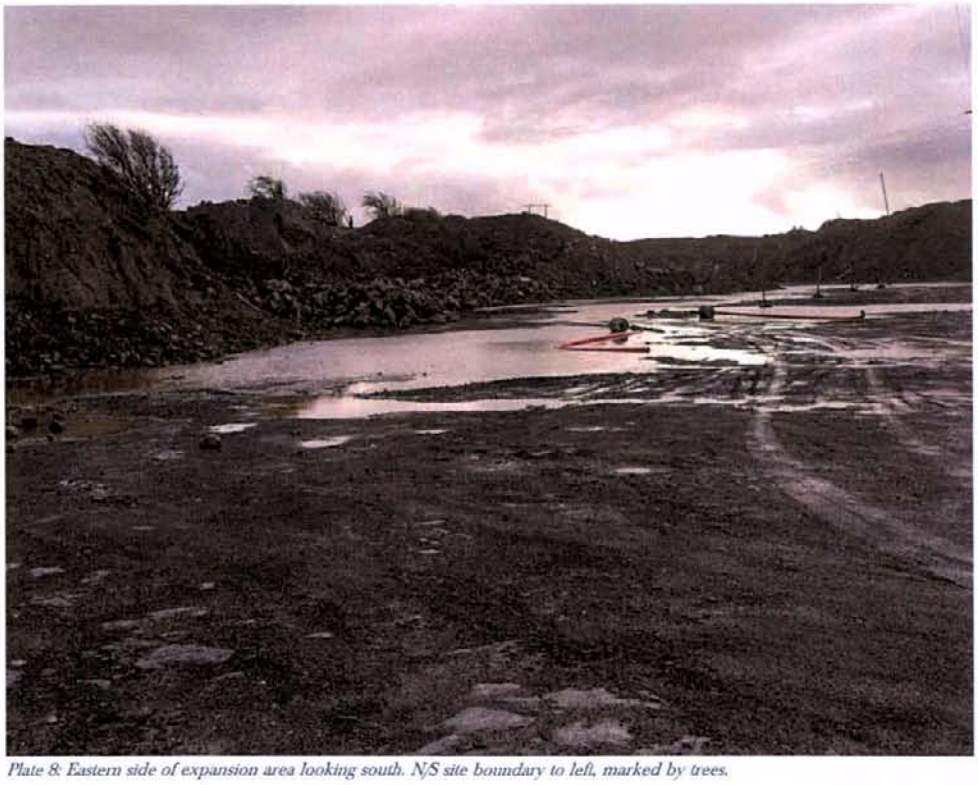


Plate 8: Eastern side of expansion area looking south. N/S site boundary to left, marked by trees.

Plate 9: Unstripped safety buffer zone under overhead line looking NW.

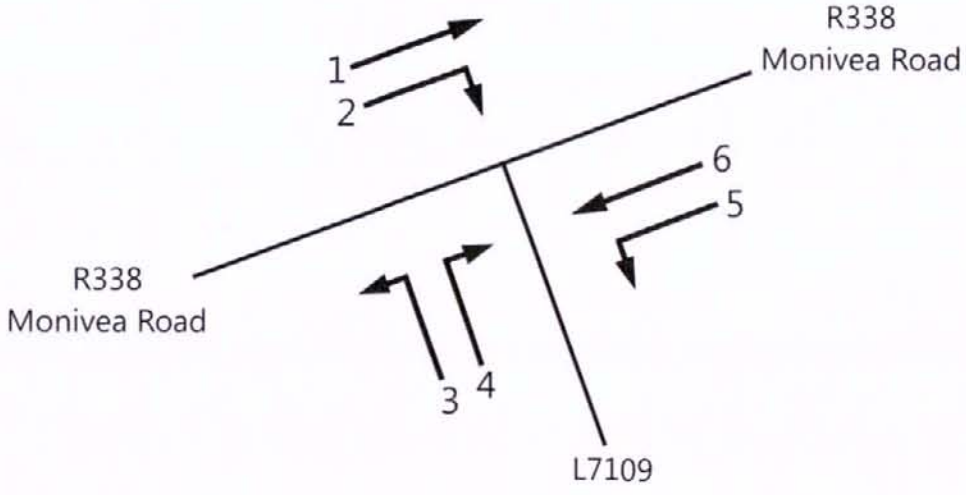
Plate 10: Northern part of extension area from within existing gravel pit looking north.

APPENDIX 12-1

TRAFFONOMICS TRAFFIC COUNT DATA

Site Location

Movement Numbering



Job number: TRA/18/134	Job Date: 4th September 2018	Drawing No: TRA/18/134-01	traffinomics.ie
Client: Alan Lipscombe	Job Day: Tuesday	Author: SPW	

TRAFFINOMICS LIMITED

R338/L7109 TRAFFIC COUNT **SEPTEMBER 2018**
MANUAL CLASSIFIED JUNCTION TURNING COUNT **ATH/18/134**

SITE: 01 DATE: 4th September 2018

LOCATION: R338 Monivea Road/L7109 DAY: Tuesday

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
7:00	14	1	0	0	0	15	15	2	1	0	0	0	3	3	2	1	0	0	0	3	3
7:15	13	2	1	1	0	17	19	3	1	0	0	0	4	4	2	0	0	0	0	2	2
7:30	15	3	1	1	1	21	24	3	2	1	1	0	7	9	3	1	0	1	0	5	6
7:45	18	3	2	0	0	23	24	11	3	0	0	0	14	14	5	0	0	2	0	7	10
8:00	13	4	1	0	0	18	19	5	3	0	0	0	8	8	2	0	0	1	0	3	4
8:15	26	4	0	0	2	32	34	2	1	0	0	0	3	3	0	1	0	0	0	1	1
8:30	18	5	1	0	0	24	25	7	0	0	1	0	8	9	5	0	0	0	0	5	5
8:45	21	5	2	0	0	28	29	2	1	0	0	0	3	3	3	0	0	0	0	3	3
9:00	16	4	0	0	0	20	20	1	0	0	3	0	4	8	5	1	0	0	0	6	6
9:15	10	3	0	0	0	13	13	3	0	0	1	0	4	5	2	2	0	0	0	4	4
9:30	14	4	3	0	2	23	27	0	1	0	0	0	1	1	2	2	0	1	0	5	6
9:45	15	0	2	0	0	17	18	1	2	0	0	0	3	3	0	0	0	0	0	0	0
P/TOT							100							34							21

	MOVEMENT 1							MOVEMENT 2							MOVEMENT 3						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
16:00	52	7	1	0	0	0	61	6	1	2	1	0	10	12	1	3	0	0	0	4	4
16:15	94	9	0	2	0	105	108	8	0	0	0	0	8	8	1	1	0	0	0	2	2
16:30	69	11	2	0	0	82	83	1	1	0	0	0	2	2	23	2	1	0	0	26	27
16:45	74	12	2	1	1	90	93	3	0	0	1	0	4	5	2	0	1	0	0	3	4
17:00	78	10	1	0	0	89	90	3	1	0	1	0	5	6	8	0	0	1	0	9	10
17:15	90	14	1	0	0	105	106	4	0	0	0	0	4	4	5	0	0	0	0	5	5
17:30	103	20	0	1	0	124	125	1	1	0	1	0	3	4	3	2	0	0	0	5	5
17:45	88	4	1	0	1	94	96	4	0	0	0	0	4	4	1	1	0	0	0	2	2
18:00	79	8	3	0	1	91	94	1	0	0	0	0	1	1	1	0	0	0	0	1	1
18:15	77	5	2	0	0	84	85	2	1	0	0	0	3	3	1	0	0	0	0	1	1
18:30	51	7	0	0	0	58	58	2	0	0	0	0	2	2	3	1	0	1	0	5	6
P/TOT							373							22							42

TRAFFINOMICS LIMITED

R338/L7109 TRAFFIC COUNT **SEPTEMBER 2018**
MANUAL CLASSIFIED JUNCTION TURNING COUNT **ATH/18/134**

SITE: 01 DATE: 4th September 2018

LOCATION: R338 Monivea Road/L7109 DAY: Tuesday

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
7:00	0	1	0	3	0	4	8	0	0	0	0	0	0	0	69	14	1	0	0	84	85
7:15	0	1	0	1	0	2	3	7	0	1	2	0	10	13	85	12	0	0	2	99	101
7:30	0	0	0	2	0	2	5	11	1	0	1	0	13	14	111	19	0	0	2	132	134
7:45	2	3	0	4	0	9	14	36	5	0	1	1	43	45	112	19	0	0	0	131	131
8:00	1	2	2	2	0	7	11	3	0	0	2	0	5	8	87	10	0	0	0	97	97
8:15	2	0	0	2	0	4	7	8	2	0	2	0	12	15	73	9	0	0	1	83	84
8:30	4	0	0	2	0	6	9	10	1	0	1	0	12	13	74	11	0	1	0	86	87
8:45	2	0	0	3	0	5	9	6	0	0	2	0	8	11	56	8	1	0	1	66	68
9:00	5	0	0	2	0	7	10	2	0	1	2	0	5	8	38	9	1	0	0	48	49
9:15	7	0	0	4	0	11	16	4	1	0	2	0	7	10	47	3	1	0	0	51	52
9:30	2	0	0	2	0	4	7	3	0	0	4	0	7	12	41	5	1	1	1	49	52
9:45	1	0	1	1	0	3	5	3	0	0	2	0	5	8	30	3	3	0	0	36	38
P/TOT							36							82							446

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
16:00	4	1	0	5	0	10	17	4	2	1	0	0	7	8	31	6	1	0	0	38	39
16:15	2	0	0	0	1	3	4	2	2	2	1	0	7	9	23	6	1	0	2	32	35
16:30	43	2	0	1	0	46	47	1	3	0	1	0	5	6	27	4	2	0	0	33	34
16:45	5	2	0	0	0	7	7	4	0	0	3	0	7	11	23	2	2	1	1	29	32
17:00	15	3	1	0	0	19	20	3	2	1	1	0	7	9	24	2	1	0	1	28	30
17:15	9	2	1	0	0	12	13	1	0	0	1	0	2	3	28	2	2	0	0	32	33
17:30	8	2	0	0	0	10	10	2	1	1	1	0	5	7	29	5	1	0	0	35	36
17:45	5	0	1	0	0	6	7	4	0	0	0	0	4	4	22	1	2	0	0	25	26
18:15	1	2	0	0	0	3	3	3	0	0	0	0	3	3	18	2	0	0	0	20	20
18:30	4	0	0	0	0	4	4	0	1	0	0	1	2	3	24	1	1	0	0	26	27
18:45	4	0	0	0	0	4	4	4	0	0	0	0	4	4	25	4	1	0	0	30	31
P/TOT							78							35							130

PCU's Through Junction	By Hour
113	686
142	718
192	719
238	675
146	559
143	513
148	470
122	426
100	375
100	
104	
71	

PCU's Through Junction	By Hour
139	656
165	681
199	679
152	666
164	652
163	610
187	569
138	487
122	
123	
105	

APPENDIX 12-2

TII AUTOMATIC COUNT DATA

TII Traffic Data Site

Site Name: TMU M06 115.0 E Site ID: 000000003602 Grid: 149433226469 Description: M06 J

Channel: All directions ▾ Precision: Normal ▾ Exclude data: None ▾

Date	Monday - Friday 12Hr	16Hr	18Hr	24Hr	Monday - Sunday 12Hr	16Hr	18Hr	24Hr	am Peak Hour	Monday - Friday am Peak Flow	pm Peak Hour	p
Jan 2017	12834	14924	15349	15867	11862	13905	14323	14826	08:00	1358	17:00	
Feb 2017	13927	16245	16725	17276	13046	15318	15793	16340	08:00	1487	17:00	
Mar 2017	13997	16387	16879	17441	13175	15562	16076	16616	08:00	1473	17:00	
Apr 2017	14638	17202	17727	18318	13832	16339	16856	17426	08:00	1349	17:00	
May 2017	14576	17179	17728	18335	13892	16494	17045	17649	08:00	1440	17:00	
Jun 2017	14672	17317	17863	18508	14045	16697	17238	17871	08:00	1366	17:00	
Jul 2017	15186	17924	18525	19163	14719	17516	18137	18782	08:00	1353	17:00	
Aug 2017	15920	18741	19358	20006	15382	18222	18849	19505	08:00	1357	17:00	
Sep 2017	15305	18040	18593	19216	14560	17338	17928	18541	08:00	1544	17:00	
Oct 2017	15832	18532	19085	19766	15230	17912	18450	19118	08:00	1560	17:00	
Nov 2017	16497	19301	19862	20551	15682	18378	18937	19605	08:00	1663	17:00	
Dec 2017	14707	17169	17697	18327	14042	16375	16876	17510	08:00	1278	17:00	

Site Name: TMU M06 115.0 E Site ID: 000000003602 Grid: 149433226469 Description: M06 Jn16 Carrowkeel

Setup: Setup0591 | Precision: Normal | Exclude data: None

	Eastbound On Ramp	Eastbound Slow	Eastbound Fast	Westbound Fast	Westbound Slow	Westbound Off Ramp	Total
00:00	5	52	4	5	50	9	125
01:00	4	38	2	3	36	7	92
02:00	4	37	3	3	33	5	84
03:00	4	30	2	2	28	3	69
04:00	5	32	2	2	30	3	73
05:00	12	63	7	8	69	5	164
06:00	30	126	18	57	206	14	451
07:00	72	239	60	200	373	48	993
08:00	109	298	87	181	400	83	1159
09:00	75	278	64	115	352	70	954
10:00	65	313	75	84	321	55	913
11:00	74	360	100	91	341	56	1022
12:00	76	392	120	110	370	63	1132
13:00	78	400	124	122	388	69	1181
14:00	76	409	132	122	386	74	1200
15:00	81	450	163	125	390	85	1293
16:00	95	508	220	126	382	101	1431
17:00	110	516	257	137	394	126	1539
18:00	86	435	178	126	369	108	1302
19:00	57	307	96	89	303	75	917
20:00	41	225	47	63	246	53	675
21:00	31	169	29	42	195	41	506
22:00	17	113	15	23	134	28	330
23:00	8	80	8	11	86	15	208
07-19	998	4598	1580	1540	4465	939	14120
06-22	1157	5425	1760	1790	5414	1122	16668
06-24	1182	5619	1783	1824	5634	1164	17206
00-24	1215	5871	1802	1848	5882	1196	17814
am Peak	08:00	11:00	11:00	07:00	08:00	08:00	08:00
Peak Volume	109	360	100	200	400	83	1159
pm Peak	17:00	17:00	17:00	17:00	17:00	17:00	17:00
Peak Volume	110	516	257	137	394	126	1539

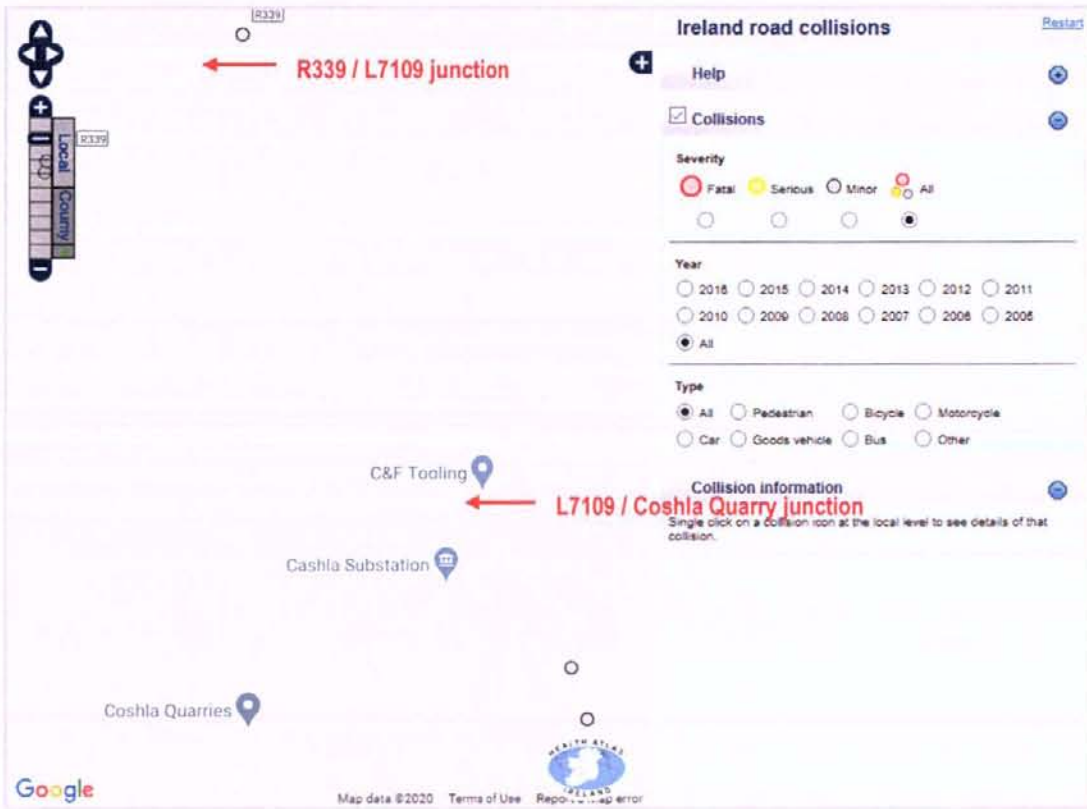
MKO

APPENDIX 12-3

RSA COLLISION DATABASE EXTRACT

APPENDIX 12.3

Road Safety Authority Collision Data – 2005 to 2016



APPENDIX 12-4

R339 / L-7109 JUNCTION CAPACITY ANALYSIS

Appendix 12.4

PROPOSED QUARRY EXTENSION, COSHLA QUARRY, BARRETTSPARK, ATHENRY

COUNTY GALWAY

R339 / I7109 Junction Capacity Assessment

Alan Lipscombe Traffic & Transport Consultants Ltd
Claran, Headford, Co Galway

Email -Info@alipscombetraffic.ie
Tel – 093 34777
Mob – 087 9308134

Client: Coshla Quarry
February 20tht, 2020
Project No: 6260

Introduction

The traffic impact of the proposed quarry extension and the cumulative impact with a Battery Storage Plant recently granted planning permission by Galway County Council on a neighbouring site was assessed at the R339 / L7109 junction using the industry recognised junction analysis programme PICADY for priority junctions. The programme permits the capacity of any junction to be assessed with respect to existing or forecasts traffic movements for a given time period. The capacity for each movement possible at the junction being assessed is determined from geometric data with the output used in the assessment as follows:

- Queue – This is the average queue forecast for each movement and is useful to ensure that queues will not interfere with adjacent junctions.

- Ratio of flow to capacity (RFC) – As suggested, this offers a measure of the amount of available capacity being utilised for each movement. Ideally each movement should operate at a level of no greater than 0.85, or at 85% of capacity.

- Delay – Output in minutes, this gives an indication of the forecast average delay during the time period modelled for each movement.

Scenarios modelled

Tests were undertaken at the R339 / L7109 junction for the AM and PM peak hours, for the following scenarios;

- Existing quarry development for years 2021 and 2036,
- With proposed quarry extension for years 2021 and 2036, and
- With proposed quarry extension and the granted battery storage plant development.

The traffic flows for each scenario are set out in Figures 12.2 to 12.12 attached.

Capacity test results

The results of the capacity tests for the R339 / L7109 junction are shown for the AM and PM peak hours in Tables 1 and 2. The results show that by the future year 2036 the maximum ratio of flow to capacity (RFC) will apply to traffic accessing the R339 from the L7109, and will reach a maximum of 53.8% based on the existing level of development during the PM peak hour. This is forecast to increase to 58.9% with the introduction of the proposed quarry extension, and to 63.8% with the inclusion of the Battery Storage

facility tested for the purpose of potential cumulative impact. With up to 85% considered to be acceptable, it is forecast that the R339 / L7109 junction will operate well within capacity for all scenarios, and that the proposed quarry extension will have a marginal impact on the junction capacity.

Table 1 Junction capacity test results - R339 Monivea Road / L7109 junction, without and with proposed development, AM peak hour

Year	Arm	Existing			With dev			With dev + Battery Storage		
		RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay
2021	Onto R339 Monivea Road	20.8	0.26	0.22	23.3	0.3	0.23	NA	NA	NA
	Right turn into L7109	11.3	0.17	0.14	11.9	0.18	0.14	NA	NA	NA
2036	Onto R339 Monivea Road	33.3	0.49	0.32	36.3	0.56	0.34	39.4	0.64	0.36
	Right turn into L7109	17.9	0.32	0.15	18.4	0.33	0.15	19.2	0.35	0.16

Table 2 Junction capacity test results - R339 Monivea Road / L7109 junction, without and with proposed development, PM peak hour

Year	Arm	Existing			With dev			With dev + Battery Storage		
		RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay
2021	Onto R339 Monivea Road	37.1	0.58	0.24	41.2	0.69	0.25	NA	NA	NA
	Right turn into L7109	7.4	0.13	0.08	8.4	0.16	0.08	NA	NA	NA
2036	Onto R339 Monivea Road	53.8	1.14	0.36	58.9	1.39	0.4	63.8	1.64	0.45
	Right turn into L7109	11.7	0.27	0.07	12.8	0.31	0.08	14	0.36	0.08