9 February 2011

Licensing Unit
Office of Climate Change, Licensing and Resource Use
Environmental Protection Agency
Headquarters,
P.O. Box 3000,
Johnstown Castle Estate
County Wexford

Our Ref: 501.00059.00017
Your Ref : W0272-01

Dear Sir/ Madam

RE: ROADSTONE WOOD LIMITED : WASTE LICENCE APPLICATION
MILVERTON WASTE RECOVERY FACILITY
RESPONSE TO ARTICLE 14 COMPLIANCE NOTICE

Further to your letter dated 22 October 2010 last issued in accordance with Article 14(2)(b)(ii) of the Waste Management (Licensing) Regulations, we have herein provided the additional information, particulars and evidence requested to achieve compliance with the requirements of Articles 12 and 13 of the Regulations.

We have addressed each of the points raised in your letter in turn below:

ARTICLE 12 COMPLIANCE REQUIREMENTS

1. **A submission from Fingal County Council was received by the Agency on the 19th December 2009. The County Council states that the works to be carried out on site, including the importation of large quantities of material will require planning permission under Section 32 of the Planning and Development Act 2000. Please provide clarification in relation to the planning status of the site, including importation of material; also address the planning issues raised in the submission from Fingal County Council.**

   As indicated in Section 1.5 of the Environmental Impact Statement which accompanies this Waste Licence Application, the proposed backfilling of the existing quarry at Milverton has previously been agreed and approved by the Planning Department of Fingal County Council, in accordance with procedures set out in the conditions imposed on its operation under Section 261 of the Planning and Development Act of 2000.

   Milverton Quarry, by virtue of its pre-1964 planning status, was required to register with Fingal County Council under Section 261 of the Planning and Development Act of 2000. This was duly done, within the statutory timeframe, on 22 April 2005. As it was empowered to do under the Act of 2000, Fingal County Council subsequently decided, on 19 April 2007, to impose 14 conditions on the operation of the quarry.

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A copy of Fingal County Council's Notification of Decision to Impose Conditions (Reference No. Q/05/0003) and An Bord Pleanála's subsequent decision of 21 January 2008 (Reference No. 06F.QC.2119) to substantially uphold these conditions are provided in Attachment B3 of the Waste Licence Application.

As can be seen, Condition No. 12 of the Section 261 Conditions provides for phasing of the quarry development, while Condition No. 13 provides for its landscaping and restoration / afteruse. On 3 October 2008, Roadstone Dublin (as it then was, *now* Roadstone Wood) submitted a restoration plan to Fingal County Council in accordance with the requirements of Condition No. 13 which provided for the restoration of the quarry as outlined in this Waste Licence Application. Approval of the restoration plan was issued by Fingal County Council on 4 August 2009. A copy of the letter signed by a Senior Executive Officer of the Planning Department confirming that the restoration proposal was acceptable on planning grounds is also provided in Attachment B3 of the Waste Licence Application.

Roadstone Wood asserts that the conditions imposed on the operation of Milverton Quarry under the Section 261 quarry registration and its subsequent engagement with Fingal County Council as envisaged by, and provided for under these conditions, provide the necessary statutory approval for the proposed quarry backfilling and quarry restoration activity.

The Agency will note the extended time period over which the Applicant was engaged in securing the necessary Section 261 decisions and approvals between 2005 and 2009, which included an appeal to An Bord Pleanála. The Applicant considers that all planning issues in respect of development activity at the application site have been adequately considered and addressed by the Section 261 process over this time and that the planning status of Milverton Quarry, including its final restoration, is now clear.

It is noted that Fingal County Council, in its letter dated 9 December 2009 identifies a number of concerns in respect of water services and transportation aspects of the development. Notwithstanding the Applicant's assertions above, it is considered that the water supply, drainage and water pollution control issues raised by the Council are (or can be) adequately addressed and resolved under Condition 9 of its Section 261 decision as well as conditions which might attach to the proposed waste licence.

The Applicant asserts that all concerns previously identified in respect of the transportation and traffic issues were addressed by Fingal County Council under Condition 10 of its Section 261 decision. Mindful of the pre-1964 status of the quarry, its long-established land use and continued operation, the Council, in setting conditions on the operation of the quarry, chose not to impose any requirement to achieve visibility sightlines complying with the Department of Transport's *Traffic Management Guidelines* and/or the National Roads Authority's *Design Manual for Roads and Bridges.*

As regards Fingal County Council's requirement for a rather generous contribution of €500,000 towards road improvements in the area, the Agency will note (with healthy scepticism) that a previous attempt by the Local Authority to recover a standard development contribution of €136,488 under Condition 14 of its Section 261 decision was rejected on appeal to An Bord Pleanála, as it (ABP) considered that there was no statutory provision for development contributions under Section 261 of the Planning and Development Act of 2000 (refer again to An Bord Pleanála's decision in Attachment B3 of the Waste Licence Application).

2. Provide details of any consultation with the National Parks and Wildlife Service in relation to the following:

(i) The protected status of the peregrine falcon present on-site;
(ii) The possible impacts associated with the proposal to infill the quarry on the peregrine falcon; and
(iii) The suitability of the proposal to retain an upper section of the southern quarry face as a continued nesting habitat for the peregrine falcon.

In preparing the flora and fauna chapter of the EIS, some informal contacts were made with National Parks and Wildlife Service (NPWS) about sites of conservation importance (Special Areas of Conservation and Special Protection Areas) in the vicinity of the application site and on the implications of continued quarrying activity and/or quarry backfilling / restoration for the peregrine falcon.

As planning control and approval both for the quarry and the proposed restoration scheme had been achieved, it was considered that there was no requirement to consult formally with the Development Applications Unit of NPWS.

In undertaking the flora and fauna study, and pursuant to the requirement for such a study under Condition 11 imposed under the Section 261 registration process, consultations and discussions were also had with two officials from Fingal County Council, specifically

Deborah Tiernan – Fingal County Council Biodiversity Officer
Gerry Clabby – Fingal County Council Heritage Officer

The Peregrine Falcon is afforded statutory protection by the Wildlife Act of 1976 (No. 39 of 1976), the Wildlife (Amendment) Act of 2000 (No. 38 of 2000) and Annex 1 of the Birds Directive (2009/147/EC). This protection extends to its nests and eggs.

Abandoned quarry faces, such as the western quarry face at Milverton provide secure nesting sites for birds of prey such as the peregrine falcon to rear their young. Anecdotal evidence from quarry personnel at the time of the ecological survey in May 2008 was that a falcon had successfully nested in this habitat for a number of years. The experience of the ecological consultants retained by Roadstone Wood is that the use of abandoned quarry faces for nesting purposes by peregrine falcons is not unusual, even within quarries which continue in operation. Quarrying is arguably beneficial in that it creates new habitat which extends the range of the peregrine falcon inland from coastal areas, where they are predominantly to be found nesting in sea cliffs.

Given that the peregrine falcon had established a nest and had become accustomed to noise and vibrations generated by ongoing quarrying and concrete production activity at the quarry at the time of the survey, the ecological consultants considered that continued disturbance associated with quarrying activity and the potentially reduced disturbance associated with backfilling and restoration of the quarry were unlikely to have any significant impact on the peregrine falcon's continued use of the quarry face for nesting purposes.

Given the peregrine falcon's protected status under the Wildlife Acts and Annex 1 of the Birds Directive and its ecological interest value, the ecological consultants recommended that a high cliff face, suitable for roosting and nesting by the Peregrine Falcon, should be retained at the site. The height of the retained quarry face, at approximately 8m to 10m, was considered sufficient to provide protection to the nest and eliminate the risk that it could be accessed and destroyed by human predators.

This proposal was further discussed at a site meeting on 14 December 2010 last which was arranged in response to the Agency's request for clarification of NPWS' view of the restoration proposal. The meeting was attended by the undersigned, Shane Geraghty of Roadstone Wood and Niall Harmey, the local NPWS ranger. At the meeting, Niall Harmey, on behalf of NPWS indicated its general agreement to the proposal subject to some minor modifications as follows

(i) The area of abandoned quarry face which will remain permanently exposed should to be extended to cover a greater area than that previously indicated around the existing nest site. The approximate extent of the extended quarry face is as indicated on the attached drawing (Figure 2.5 Rev A).
(ii) The area in front of the quarry face should be made relatively flat and open to view from the front (west), again as indicated on the attached drawing
(iii) NPWS to be notified in advance of any restoration / backfilling works commencing at the quarry
(iv) The methodology to be employed in backfilling the quarry to be developed / finalised in consultation from NPWS to ensure ecological concerns, particularly in respect of the peregrine falcon nesting at the site, are appropriately identified and addressed.

A copy of recent email correspondence with NPWS, confirming outline agreement to the restoration proposal is provided under cover of this letter.

3. Clarify the hours it is proposed to accept waste at the proposed facility and the hours when waste will be infilled on site, if different.

Imported waste materials will be accepted at the proposed waste facility between 07.00 hours and 18.00 hours each weekday and between 07.00 hours and 13.00 hours on Saturday. No materials will be accepted at any other time, including on Sunday and on Public Holidays.

It is envisaged that infilling activities will be undertaken at the site will be undertaken during the same periods as indicated above.

The proposed working hours are the same as those laid down by An Bord Pleanála in its confirmation of the decision of Fingal County Council to impose conditions on the operation of a registered quarry under Section 261 of the Planning and Development Act of 2000 (ABP Reference Number 06F.QC.2119 and Fingal County Council Planning Reference Number Q/05/0003, copies of which are provided in Attachment B3 of the Waste Licence Application.

4. Clarify the grid references for dust monitoring point D3, surface water monitoring points SW1 and SW2 and groundwater monitoring point BH03

The grid reference point for Dust Monitoring Point D3 is 324602E 259053N
The grid reference point for Surface Water Monitoring Point SW1 is 324582E 259158N
The grid reference point for Surface Water Monitoring Point SW2 is 324839E 259330N
The grid reference point for Groundwater Monitoring Point BH03 is 324672E 259053N

The previously incorrect grid references provided on

Table F3.1 of Attachment F3 (Air Quality Monitoring Points)
Table F4.1 of Attachment F4 (Surface Water Monitoring Points) and
Table F6.1 of Attachment F6 (Groundwater Monitoring Points)

have been corrected on the revised Attachments enclosed under cover of this letter.

5. In relation to discharges to surface water, please provide the following:

(i) Complete Table E.1(i) *Emissions to Surface Waters* and Table E1(ii) *Emissions to Surface Waters – characteristics of the emission* to include reference to suspended solids

(ii) The proposed concentration of suspended solids in the discharge to surface water following settlement

(iii) Details of how the rate of discharge of the stream will be controlled, times of discharge, predicted discharge volumes and proposed monitoring of the discharge (including visual, chemical and flow).

(iv) Confirm the route of the existing pipeline from the quarry to the receiving water. Alternatively identify an alternative proposed route for discharge of the on-site water to the receiving water. Clarify the location of the existing or proposed discharge point to the receiving water and provide the grid reference. Identify the existing or proposed discharge route on a fully labelled drawing.

(v) Provide and assessment, with particular reference to suspended solids of the impact of the emissions to the receiving water. The assessment shall have regard to the standard for suspended solids in European Communities (Quality of Salmonid Waters Regulations) 1988, SI No. 293.

(i) Details of the proposed surface water discharge to the tributary of the Mill Stream which runs north and east of the application site are provided in Tables E.1 (i) and E.1(ii). The completed tables are provided under cover of this letter, as requested.

(ii) The maximum concentration of suspended solids in the surface water discharge to the tributary of the Mill Stream will be 35 mg/litre.

The proposed emission limit values for suspended solids and other parameters included in Table E.1 (ii) are consistent with those recommended by the guidance document *Environmental Management in the Extractive Industry* published by the Agency (EPA, 2006) and which, in our (SLR's) experience, is conventionally applied by Local Authorities when regulating surface water discharges from quarries to non-salmonid rivers and streams across Ireland.

(iii) The discharge to the tributary of the Mill Stream which runs north and east of Milverton Quarry predominantly comprises surface water run-off into the quarry void. There is relatively little groundwater ingress through the limestone faces. This is evidenced by the relatively low level of water currently ponding on the floor of the quarry even though it lies below sea level (at-9.5mOD) and has not been pumped since rock extraction and pumping from the quarry floor were both suspended in summer 2008.

The rate, timing and volume of discharge to the receiving waters will be variable and controlled by precipitation patterns over the proposed restoration phase. For a quarry void of approximately 5.41 hectares, with an annual average rainfall of 802mm/year and assuming zero evapotranspiration (on account of absence of vegetation), the average run-off volume, and volume discharged to the receiving waters, is approximately 119m^3/day or 1.38 litres/sec. In practice, the discharge volume will vary between 0 litres/sec when no rain falls and approximately 15.7 litres/sec during a 1 in 50 year storm event (50mm rainfall in 48hours).

Pumping of surface water run-off out of the quarry void will be controlled by automated pumps placed in sumps at local low points. Pumping of water to the settlement ponds at original ground level at the front (northern end) of the site

will commence automatically once water levels in the sumps attain a pre-set level and cease once levels in the sump fall to another pre-set level.

It is envisaged that the quality of the surface water discharging from the settlement ponds will be monitored prior to being discharged via the existing buried discharge pipe to the tributary of the Mill Stream. The parameters to be monitored will include those conventionally required for extractive industries and/or EPA licensing of soil recovery facilities, including physical parameters (temperature, pH, dissolved oxygen, electrical conductivity, suspended solids, visual/odour), chemical parameters (nitrate, ammoniacal nitrogen, chloride, sulphate, dissolved metals, non-metals, total hydrocarbons and List I/II substances) and biochemical oxygen demand (BOD).

(iv) As was previously alluded to, it is envisaged that the existing surface water discharge pipe between the quarry and the tributary of the Mill Stream will continue in service during the quarry backfilling and restoration phase.

A follow up topographical survey was undertaken at the application site on 26 November 2010. The principal objective of this survey was to locate the start and end points of the existing discharge pipe and the crown and invert level of the pipe at either end. The start point for the 150mm diameter discharge pipe is located at the base of a manhole in the former retail centre (at Grid Reference 324648E and 259158N), located at the front (northern end) of the quarry. The invert level of the pipe at this point lies approximately 4.5m below the ground surface, at 16.56mOD.

The end point for the discharge pipe daylights as a stone culvert in the bank of the tributary to the Mill Stream, beyond the north-eastern boundary of the quarry and close to a right angle bend in the channel (at Grid Reference 324838E and 259329N). It is known that quarrying activity has been undertaken at the application site since the mid-1800's and the presence of the stone culvert would suggest that this discharge has been in use for a considerable period of time. The invert level at the discharge point is 15.36mOD, 1.2m lower than the invert level of the pipe at the quarry, giving an average pipe gradient of approximately 1 in 200 (0.0005). Drawing E1.1 has been updated to show the surveyed start and end points of the discharge pipe and its inferred alignment.

(v) As long as quarrying has been undertaken at Milverton (up to summer 2008), surface water run-off collecting on the quarry floor has been discharged without any form of treatment to the manhole at the rear of the retail centre and from there to tributary of the Mill Stream.

Two water samples were taken from the tributary of the Mill Stream on 26th November 2010, one upstream from the site (SW1) and one downstream from the site (SW2), at the discharge point. There was no discharge from the quarry to the stream at the time the samples were taken. The test results are presented in Appendix 6.2 attached.

The sample results indicate that water in the stream is generally of good quality, with some suspended solids. The slightly elevated chloride in the stream is likely to be associated with the coastal location of the catchment and the elevated nitrates most likely reflect runoff from agricultural lands in the catchment. The elevated Phosphorus levels in the stream most likely reflect human activities in the catchment.

A water sample (D1) was also taken from the sump on the quarry floor on the same day. This sample is deemed to be characteristic of water likely to be discharged from the quarry floor to the tributary of the Mill Stream. These tests results are also presented in Appendix 6.2 (enclosed).

The water quality test results indicate that the ponded water on the floor of the quarry is of good quality with slightly elevated chloride (associated with the coastal location) and elevated nitrates (reflecting runoff from agricultural lands immediately up-gradient of the quarry). The low phosphorus levels, below the laboratory detection level, in the sample indicate no human impacts on the water quality in the quarry void. There were no hydrocarbons recorded in the sample.

Impact on Flow Volume

Resumption of discharge from Milverton Quarry to the stream has the potential to impact directly on the quantity of water flowing in it, as an additional volume is added from the quarry. A summary flow report for the Mill Stream at the discharge point was generated using the EPA Hydro Tool for flow estimation in ungauged catchments, a copy of which is included in Appendix 6.3 (enclosed).

The flow report indicates that the 50%ile flow in the stream is approximately 0.062m^3/sec while the 95%ile flow is estimated to be 0.028m^3/sec based on a catchment area of 8.2km^2. The annual average discharge of approximately 1.38litres/sec (0.0013m^3/sec) from the quarry therefore accounts for approximately 2% of the estimated 50%ile flow in the stream and 5% of the estimated 95%ile flow. It is therefore considered that the quarry discharge will have no significant adverse impact on the flow in the stream.

Impact on Flow Quality

The potential exists for deterioration in water quality in the stream from suspended solids or hydrocarbon contamination in the discharge. This could potentially arise from accidental leaks or spillages in the quarry void and have an adverse impact on the water quality in the stream. It is considered that installation of an interceptor and construction of settlement ponds upstream of the existing manhole, as proposed, and a requirement to limit suspended solids to a maximum of 35 mg/litre will mitigate potential risks to water quality in the stream. The proposed emission limit values for suspended solids is consistent with that recommended by the guidance document *Environmental Management in the Extractive Industry* published by the Agency (EPA, 2006). In view of the absence of any emission control heretofore, is considered appropriate for the proposed quarry backfilling and restoration activity. Ultimately emissions to the stream will cease once restoration of the quarry is complete.

As the Mill Stream is not statutorily designated as a salmonid water, it is considered that the emission limit value for suspended solids of 25 mg/litre (required by the European Communities (Quality of Salmonid Rivers) Regulations, S.I. No 293 of 1988) is not appropriate or necessary in this instance.

Based on the available water quality results for the water discharged from the quarry and the existing surface water in the stream, the water discharged from the quarry could potentially result in a minor improvement in water quality, at least as regards its phosphorus loading.

ARTICLE 13 COMPLIANCE REQUIREMENTS

(i) Resubmit Table 6.2 Summary of Groundwater Quality to reflect the groundwater and surface water monitoring results contained in the laboratory tables of results from Appendix C of Section 6.

Table 6.2 of Chapter 6 of the Environmental Impact Statement has been amended to show the correct parameter concentrations in the tested water sample obtained from the tributary of the Mill Stream (identified as sample SW01). The corrected table is shown in the revised EIS chapter on water provided under cover of this letter.

(ii) Please update the EIS documents as necessary having regard to the information provided in response to Article 12 compliance requirements above.

In light of the Article 12 information requirements addressed by this letter, it is considered necessary to make minor amendments to the following EIS Chapters

Chapter 4	Flora and Fauna
Chapter 6	Water

In addition, two appendices to Chapter 6 are also added (Appendices 6.2 and 6.3), together with an amended EIS Contents List.

It is considered that the responses provided above do not require any material change to be made to the original Non-Technical Summary of the Environmental Impact Statement.

We trust that the answers provided above adequately address the issues raised in your letter and that you will shortly be in a position to issue a proposed determination on this waste licence application.

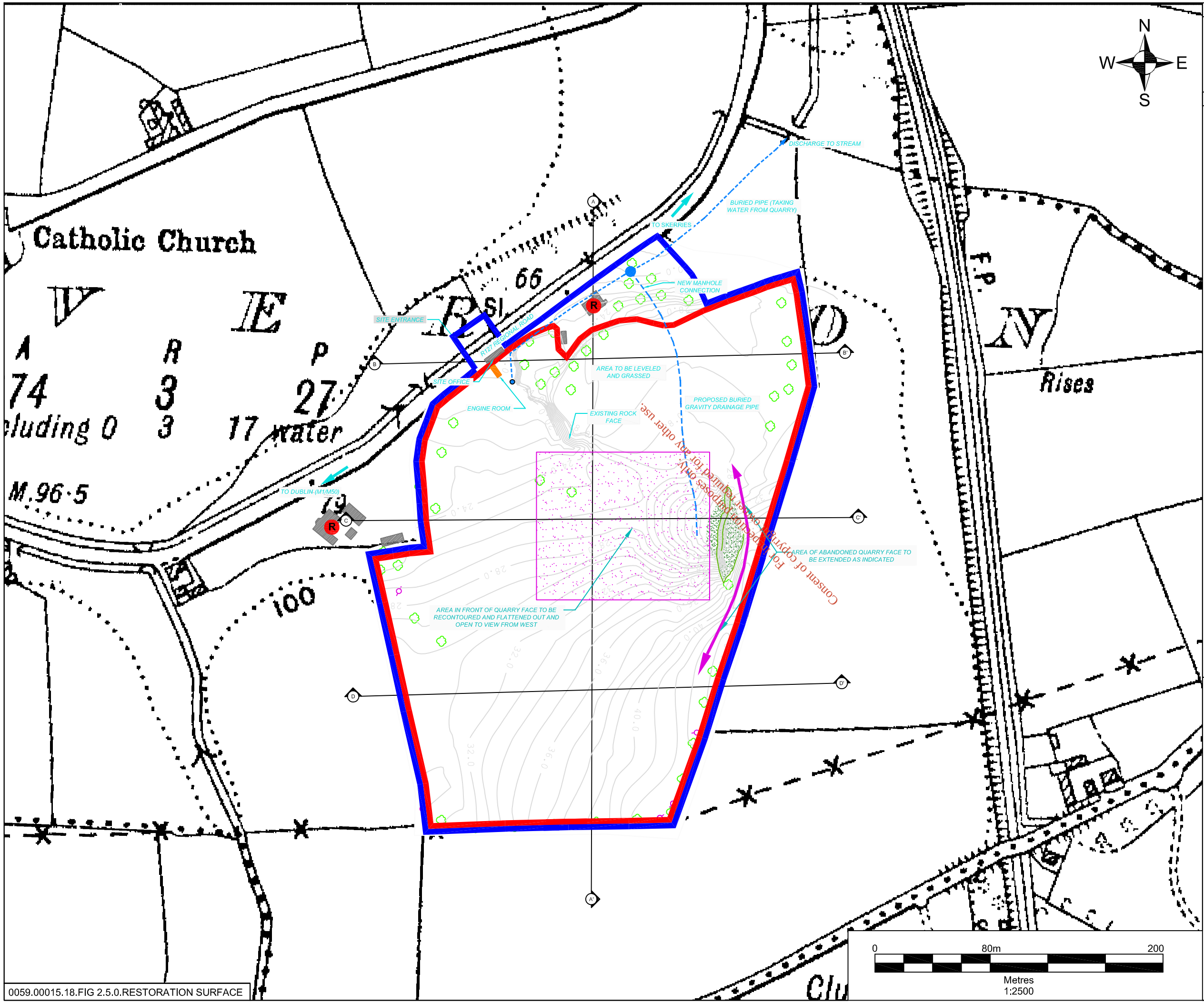
Yours sincerely
SLR Consulting Ireland

Derek Luby
Technical Director

cc Ronan Griffin (Roadstone Wood)

Enc Email Correspondence with NPWS (Niall Harmey)
(including Figure 2.5 Rev A showing modification of Final Restoration Profile)

Completed Tables E1 (i) and E1 (ii)
Drawing E1.1 (Rev A)
Attachment F3 (Rev. A)
Attachment F4 (Rev. A)
Attachment F6 (Rev. A)
Revised Chapter 4 (Flora and Fauna) of EIS
Revised Chapter 6 (Water) of EIS
Appendix 6.2 Surface Water Quality Data (November 2010)
Appendix 6.3 Assessment of Flow in Tributary of Mill Stream
Revised EIS Contents List



NOTES

1. Based on OSi 25inch Dublin Sheet No. 5 & 5a

2. Ordnance Survey of Ireland Licence No. SU 0000711 (c) Ordnance Survey of Ireland & Government of Ireland

LEGEND

- Applicant's Land Interest (c. 8.6ha)
- Waste Licence Application Area (c. 7.9ha)
- Cross Sections
- Buried Pipe
- Top of Bank
- Bottom of Bank
- Road
- Contour Line
- Building
- Location of Residence
- Engine Room

0 80m 200

Metres
1:2500

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SKERRIES, CO. DUBLIN

RESTORATION SURFACE

FIGURE 2.5 REV A

Scale: 1:2,500 @ A3

Date: FEBUARY 2011

0059.00015.18.FIG 2.5.0.RESTORATION SURFACE

TABLE E.1(i): EMISSIONS TO SURFACE WATERS
(One page for each emission)

Emission Point:

Emission Point Ref. N^{o}:	SW2
Source of Emission:	Collected surface water run-off (rainfall) arising within the footprint of the existing quarry void
Location :	East of Milverton Quarry, at a right angle bend in the tributary to the Mill Stream
Grid Ref. (10 digit, 5E,5N):	32484E 25933N
Name of receiving waters:	Unnamed stream to north and east of application site. Identified as a tributary of the Mill Stream
Flow rate in receiving waters:	0.0015 $m^3.sec^{-1}$ Dry Weather Flow 0.007 $m^3.sec^{-1}$ 95%ile flow (Based on EPA DWF Estimates 2007)
Available waste assimilative capacity:	Refer to Table E.1 (ii)

Emission Details:

(i) Estimated volume to be emitted			
Normal/day	118.8m^3/day	Maximum/day	1,352 m^3/day (1 in 100yr rainfall event)
Maximum rate/hour	56.4m^3/hr (1 in 100yr rainfall event)		

TABLE E.1(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW2

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	Max.[1] (kg/day)	Max.[1] (kg/year)	
Total Suspended Solids	Not Monitored	Not Monitored			35mg/l	35mg/l	4.16kg/day	1516kg/yr	
pH	Not Monitored	Not Monitored			9	9			
Biochemical Oxygen Demand	Not Monitored	Not Monitored			25mg/l	25mg/l	2.98kg/day	1084kg/yr	
Nitrate	Not Monitored	Not Monitored			50mg/l	50mg/l	5.95kg/day	2165kg/yr	
Chemical Oxygen Demand	Not Monitored	Not Monitored			100mg/l O_2	100mg/l O_2	11.9kg/day O_2	4331kg/yr O_2	
Total Hydrocarbons	Not Monitored	Not Monitored			1mg/l	1mg/l	0.12kg/day	43.7kg/yr	

[1] Based on average daily flow rate of 119m^3/day

DISCHARGE TO STREAM
LEVEL 15.3mOD

BURIED PIPE (TAKING WATER FROM QUARRY)

TO SKERRIES

R127 REGIONAL ROAD

SITE OFFICE

SITE ENTRANCE

WEIGHBRIDGE

EXISTING MANHOLE COVER LEVEL 21.03mOD

PROPOSED HYDROCARBON INTERCEPTOR

CAR PARKING AREA

PROPOSED SETTLEMENT PONDS

PROPOSED WASTE QUARANTINE & INSPECTION AREA

PROPOSED WHEELWASH

TO DUBLIN (M1/M50)

PROPOSED BUNDED FUEL STORAGE TANK

RAMP

QUARRY FLOOR

O/B Storage

O/B Storage

R

R

N
W E
S

0 10 20 30 40m 60 80 100
Metres
1:1250

0059.00015.18.FIG E1.1.R1.SITE INFRASTRUCTURE LAYOUT

NOTES

1. Based on OSi 25inch Dublin Sheet No. 5 & 5a

2. Ordnance Survey of Ireland Licence No. SU 0000710 (c) Ordnance Survey of Ireland & Government of Ireland

LEGEND

- Applicant's Land Interest (c. 8.6ha)
- Waste Licence Application Area (c. 7.9ha)
- Buried Pipe
- Top of Bank
- Bottom of Bank
- Road
- Contour Line
- Building
- Internal Unpaved Road
- Internal Paved Road
- R Location of Residence

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SITE INFRASTRUCTURE LAYOUT

FIGURE E1.1 REVA

Scale 1:1,1250 @ A3

Date FEBUARY 2011

ATTACHMENT F3 – AIR QUALITY MONITORING AND SAMPLING

Details of the air quality monitoring and sampling to be undertaken at the proposed waste recovery facility are provided in Section 2.6.2 of the Environmental Impact Statement.

Proposed air quality monitoring locations are shown in Figure F3.1 and Figure 7.1 of the Environmental Impact Statement.

Monitoring Reference No.	Parameter	Monitoring Frequency	Location (Grid Co-ordinates)	Accessibility of Sampling Points
D1	$mg/m^2/day$	Quarterly	324659E 259162N	Easy – open ground
D2	$mg/m^2/day$	Quarterly	324597E 258865N	Easy- open ground
D3	$mg/m^2/day$	Quarterly	324602E 259053N	Easy – open ground

Table F3.1 Air Quality (Dust) Monitoring Points

ATTACHMENT F4 – SURFACE WATER MONITORING AND SAMPLING

Details of the surface water monitoring and sampling to be undertaken at the proposed waste recovery facility are provided in Section 2.6.10 of the Environmental Impact Statement.

Sampling and testing of surface water at the existing watercourse upstream and downstream of the application site will continue for as long as quarry backfilling activities are underway and for a short time thereafter.

Existing monitoring locations are shown in Figure F4.1 and Figure 2.11 of the Environmental Impact Statement. It should be noted that technically all existing surface water bodies within the application site are deemed to be groundwater features.

Monitoring Reference No.	Parameter	Monitoring Frequency	Location (Grid Co-ordinates)	Accessibility of Sampling Points
SW1	Note 1	Bi-annually	324582E 259158N	Easy : at boundary of open field
SW2	Note 1	Bi-annually	324839E 259330N	Easy : across open field

Note 1 : Surface water test parameters to include Temperature, pH, Dissolved Oxygen, Conductivity, Sodium, Potassium, Chloride, Ammoniacal Nitrogen, Sulphate, Dissolved Metals (Ca, Cu, Fe, Pb, Mg, Mn, Ni and Zn) and Total Alkalinity

Table F4.1 Surface Water Monitoring Points

ATTACHMENT F6 – GROUNDWATER MONITORING AND SAMPLING

Details of the groundwater monitoring and sampling to be undertaken at the proposed waste recovery facility are provided in Section 2.6.4 of the Environmental Impact Statement.

Proposed monitoring locations at existing groundwater wells are shown in Figure F6.1 and Figure 6.5 of the Environmental Impact Statement.

Monitoring Reference No.	Parameter	Monitoring Frequency	Location (Grid Co-ordinates)	Accessibility of Sampling Points
BH01	Note 1	Bi-annually	324617E 258974N	Easy : open ground
BH02	Note 1	Bi–annually	324803E 259107N	Easy : open ground
BH03	Note 1	Bi-annually	324672E 259123N	Easy : open ground

Note 1 : Groundwater test parameters to include Temperature, pH, Dissolved Oxygen, Conductivity, Sodium, Potassium, Chloride, Ammoniacal Nitrogen, Sulphate, Dissolved Metals (Ca, Cu, Fe, Pb, Mg, Mn, Ni and Zn) and Total Alkalinity

Table F6.1 Groundwater Monitoring Points

SECTION 4: FLORA AND FAUNA

4.1 INTRODUCTION

This chapter of the Environmental Impact Statement has been prepared by Sinead McDonnell B.Sc. AMIEMA, an Environmental Scientist,with SLR Consulting (formerly John Barnett and Associates) and Dr Patrick Ashe, B.Sc., Ph.D., F.R.E.S., an Environmental Consultant specialising in ecological studies. This chapter, which has been prepared at the request of Roadstone Dublin Ltd., assesses the ecological impact of a proposed inert soil recovery facility at Milverton, Skerries, Co. Dublin.

The application site is located approximately 1.5km south-west of the town of Skerries, Co. Dublin and 5 kilometres north-east of Lusk along the R127 Regional Road.

4.1.1 Baseline Study Methodology

The objective of this ecological study is to identify and assess the significance of the flora and fauna occurring on or in the immediate vicinity of the application site in order to determine the potential ecological impact of the proposed waste recovery facility at the site.

A field survey of the flora and fauna at the site was originally undertaken on 15th May 2008 as part of the compliance requirement for the quarry registration under Section 261 of the Planning and Development Act of 2000. The application area was inspected systematically by walking along existing boundaries and access tracks, as well as criss-crossing the site, where possible to do so. During this time, a record was made of all flora and fauna and habitat types.

All vascular plants observed during the survey were identified to species level. Identification and naming of vascular plants used Stace (2001). Bird species were noted whenever encountered or clearly identifiably through calls or song. Signs of mammal activity including tracks and footprints, scats and burrows or other resting places were searched for, as well as looking out for the mammals themselves. Invertebrates (e.g. bees and butterflies) were recorded from flowers or under stones etc. and any unusual species were noted. Information on sites of conservation importance for North County Dublin / Fingal (National Parks and Wildlife Service) was obtained during the report writing stage.

4.1.2 Relevant Legislation

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the EU Habitats Directive) and Council Directive 79/409/EEC on the conservation of wild birds (the EU Birds Directive) oblige member states to protect habitats and species that are of importance on a Europe-wide scale. Annex I and II of the Habitats Directive and Annex I of the Birds Directive list species and habitats that are of greatest conservation importance on an EU-wide scale and for which conservation areas must be designated. These designations are:

- Special Areas of Conservation (SAC) for habitats listed in Annex I of the Habitats Directive and species listed in Annex II. Some of these habitats or species are prioritised for conservation measures (* Priority Species or Habitats) and
- Special Protection Areas (SPA) for Birds listed in Annex I of the Birds Directive

A number of other Annexes in both Directives list species that require strict protection but not necessarily require designation of conservation areas. Ireland is also a signatory to a number of conservation-related agreements and conventions such as the Bern and Bonn Conventions.

The EU Directives have been transposed into Irish law through a number of legal instruments including the European Communities (Natural Habitats) Regulations 1997-2005 (the 'Habitat Regulations'), the Wildlife Acts, 1976-2000, the Planning and Development Act, 2000, and the Foreshore Acts, 1932-1992.

Other legal instruments such as the Wildlife Acts (1976 and 2000) and the Flora Protection Order (1999) also provide protection for species of national conservation importance. Proposed Natural Heritage Areas (pNHA) are conservation designated areas that protect species and habitats of regional and national importance. At a more local level, there may be objectives set out in County Biodiversity Action Plans in respect of uncommon or rare species and habitats within the County.

4.2 RECEIVING ENVIRONMENT

4.2.1 Overview of Baseline Study

Roadstone Dublin operated the application site as a limestone quarry and produced construction materials there up to August 2008. Existing limestone reserves at the site are almost exhausted and extraction activities have resulted in the creation of a large quarry void.

Practically all of the application area has been disturbed by quarrying and rock extraction activities and the only natural habitat that remains are sections of perimeter hedgerow along the site boundary. The area was surveyed on the 15th May 2008 and due to its disturbed nature (from quarrying activities), only moderate floral and faunal diversity was recorded, with 65 plant species, 19 vertebrate species (16 bird species and 3 mammal species) and 4 Butterfly species recorded.

4.2.2 Habitats

The application site under investigation includes several different habitats, principally

- a section of perimeter hedgerow which defines much of the site boundary;
- areas of scrub;
- exposed calcareous rock (including cliff faces);
- recolonising waste ground and
- the active quarry area.

The location and extent of these habitats within the application site is illustrated in Figure 4.1.

Most of the application area has been affected by quarrying activity. The quarry site includes an entrance area; site office and other buildings; weighbridge; internal access roads; parking area and a concrete manufacturing facility. The adjoining areas to the east, west and south of the application area comprise arable farmland while to the north is a section of public road.

(a) Hedgerows
Hedgerows form an almost continuous boundary around the perimeter of the application site. The majority of the hedgerow is mature and unmanaged. The predominant canopy species are a mix of both native and introduced species such as Willow (*Salix spp.*), Ash (*Fraxinus excelsior*), Hazel (*Corylus avelllana*) and Elder (*Sambucus nigra*), with non-native species including Sycamore (*Acer pseudoplatanus*), amongst others.

The understorey vegetation supports a high proportion of spinose species such as Hawthorn (*Crataegus monogyna),* Holly (*Ilex aquifolium),* Bramble (*Rubus fruticosus* agg.) and Blackthorn (Prunus spinosa) in addition to ground flora species such as Cleavers (*Galium aparine*), Scarlet Pimpernell (*Anagallis arvensis*), White Clover (*Trifolium repens*) and Herb Robert (*Geranium robertianum*).

(b) Scrub
Areas adjacent to the internal roads leading to the quarry floor have progressed from recolonising bare ground to scrub habitat. This is due to the high proportion of shrub like vegetation such as the introduced Butterfly Bush (*Buddleja davidii),* which dominates this habitat and other species such as Sycamore (*Acer pseudoplatanus*) and Willow (*Salix* sp. agg.*).*

(c) Exposed Calcareous Rock
The extraction of limestone at this site up to relatively recently means that areas of calcareous rock have been artificially exposed, forming steep cliff faces. Many of the older, residual quarry faces have patchy vegetation cover, as they have been left undisturbed for several years. A range of species have colonised these areas, including Willow (*Salix sp.agg*), Gorse (*Ulex europaeus*), Bramble (*Rubus fruticosus*) and Bracken (*Pteridium aquilinum*) to more ruderal weed species such as Coltsfoot (*Tussilago farfara*), Ragwort (*Senecio jacobaea*) and Nettle (*Urtica dioica*).

(d) Recolonising Bare Ground
This describes areas where bare or disturbed ground and artificial surfaces have been invaded by herbaceous plants. Areas along the internal roads and previously worked areas which have remained undisturbed for some time fit into this classification. The flora present is predominately ruderals and weed species. Common examples include Ribwort Plantain (*Plantago lanceolata*), Groundsel (*Senecio vulgaris*), Dandelion (*Taraxacum sp. agg*) and Hogweed (*Heracleum sphondylium*).

(e) Recently Quarried Areas
Up to relatively recently, Milverton Quarry was a fully operating limestone quarry and as a result, much of the site is classified as an active quarry. The colonization of flora and fauna has been almost completely prevented around these areas due to the extraction, processing and product storage operations. It is likely that with the passage of time, this area will start to be colonised by herbaceous plants such as those identified above.

4.2.4 Evaluation

Flora
Although habitats such as active quarry and recolonising ground constitute a large portion of the site, these habitats support little flora of interest and are of low significance. The scrub habitat found on site consists of a variety of species, but is dominated by introduced flora such as the Butterfly Bush (*Buddleja davidii)*. During the summer months, this habitat will support several species of butterfly. Although it lacks floral diversity, this habitat's ability to support certain invertebrates, increases the species diversity of the site.

Extraction of limestone rock at the site up to relatively recent times has created artificial exposures of calcareous rock and resulted in formation of cliff-like faces at the site. Although the vegetation cover of this habitat is patchy, areas that were left undisturbed have been colonised by a variety of floral species. If post-extraction habitat restoration of some areas of the quarry (in particular some sections of the residual quarry faces, is left to natural processes (rather than formal landscape restoration over the whole site), the quarry has potential to increase the biodiversity of the local area.

The final habitat found at the application site was mature hedgerow, which occurs around, and defines, most of the site boundary. It is the most biologically diverse habitat found at this site and is of highest conservation value. The hedgerow supports a large range of both native and introduced floral species. Hedgerows serve several different functions for fauna. These include song posts, nesting sites, roosting site, feeding sites, cover from predators and corridors for movement. They are also likely to prove a good source of seeds during the decommissioning of the site. As external hedgerows have a high ecological significance for this site, they will be retained as part of the final restoration scheme for the quarry.

Fauna
No mammals, amphibians or invertebrates of conservation value were recorded during the ecological survey of this area, with the exception of the Irish Hare (*Lepus timidus)* which was recorded in an adjacent agricultural field. The majority of birds recorded are common and widespread throughout Ireland. All song birds are protected under the Wildlife Act of 1976 (as amended in 2000). The swallow (*Hirundo rustica)* is also on the Amber list as it has an unfavourable conservation status in Europe.

The Peregrine Falcon (*Falco peregrinus)* was found to be nesting at the site. It was only able to colonise this area as a result of quarrying activities which provided it with a suitable nesting area on residual quarry faces, thereby enabling it to hatch and rear its young. The Peregrine Falcon is afforded statutory protection by the Wildlife Act of 1976 (No. 39 of 1976), the Wildlife (Amendment) Act of 2000 (No. 38 of 2000) and Annex 1 of the Birds Directive (2009/147/EC). This protection extends to its nests and eggs.

4.2.5 Designations

There are no designated or proposed Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or proposed Natural Heritage Areas (NHA's) within or contiguous to Roadstone Dublin's landholding, nor in the area immediately surrounding it. The nearest nature conservation

sites to the application site are the offshore SPA's at the Skerries Islands and the proposed Natural Heritage Areas (pNHAs) at Knock Lake, Bog of the Ring and Loughshinny Coast approximately 5.5km west northwest, 6km west and 2.5km east southeast of the site respectively. The location of these designated sites is shown in Figure 4.2.

The Skerries islands lie approximately 0.5km and 1.5km off the north Dublin coast and are designated SPA's on account of their importance for both breeding seabirds and wintering waterfowl, with six species having populations of national importance and and internationally important population of Brent Geese. Golden Plover and Short-eared owls, both Annex 1 species under the EU Birds directive are also present in minter months.

At the present time, no site synopses are available from the National Parks and Wildlife Service (NPWS) in respect of the proposed Natural Heritage Areas at Knock Lake and the Bog of the Ring. Knock Lake is an artificial lake which formerly provided a source of emergency water for the Wavin factory in Balbriggan and is now of botanical and zoological interest. The Bog of the Ring is a flat low-lying wetland area with impeded drainage. Although the area was drained many years ago, it still contains pockets of marsh vegetation and supports some wild birdlife. The proposed NHA at the Loughshinny Coast is designated a pNHA on geological and/or geomorphological grounds (refer to Chapter 5 of this EIS).

There is also some ecological interest in a site known as the Ballast Pit, a former worked out quarry to the north of Skerries railway station. This site has been partially restored and it includes areas which have been naturally recolonised by reed beds.

4.3 IMPACT OF THE SCHEME

4.3.1 Existing / Proposed Development

The area of the application site is approximately 7.9 hectares (19 acres). At the present time, the application site includes sections of hedgerow, areas of scrub, bare rock, hardstanding surfaces and sealed concrete surfaces. The area beyond the application site includes arable fields to the south, east, north and west.

The application area includes site offices and other structures (including a stone building described as an 'engine room', a protected structure), aggregate processing and concrete production facilities, a plant storage and service area, car parks and a weighbridge. The site is accessed directly via the R127 Regional Road. Existing quarry infrastructure (with some upgrading where necessary) will service the proposed waste recovery facility.

Roadstone Dublin Ltd is the freehold owner of the application area. The company intends to apply for a waste recovery licence to the Environmental Protection Agency to provide for backfilling of the worked-out quarry void with imported inert soil and stone.

The bulk of the materials used to backfill the existing void will comprise inert soils and stones excavated at construction sites elsewhere in the Greater Dublin Area and imported to site. A proportion of the backfill materials (approximately 23%) will come from existing soil (overburden) stockpiles and screening berms around the existing quarry. It is envisaged that as the level of backfilling approaches that of the in-situ or surrounding land, layers of subsoil will be deposited followed by a final layer of topsoil. The topsoil will be seeded with a suitable grass seed mix to produce pasture to stabilise the soil surface and prevent excessive soil runoff after precipitation.

It is likely that minor quantities of other inert concrete or brick or recovered secondary aggregate (crushed and screened concrete, bricks, tiles, and ceramics) will be used to construct temporary haul roads across the application site, as and when required. These materials will either be imported directly to site or sourced from the Applicant's construction and demolition waste recovery facility at Huntstown Quarry.

It is understood that when inert materials are imported to site, they will be checked prior to being unloaded and placed at the active backfill area. If minor quantities of non-inert waste (wood, metals, plastics, etc.) are intermixed with the imported soil, it will be removed by hand or machine and stored temporally in skips at the site. When full, these skips will be dispatched to appropriately licenced or permitted waste disposal or recovery facilities.

4.3.2 Relevant Aspects of Scheme

Backfilling and restoration of the quarry using naturally occurring inert materials will give rise to the following impacts within the application area:

- Loss of approximately 1.0 hectares of naturally re-colonised scrub
- Loss of approximately 1.1 hectares of bare ground and/or exposed calcareous rock
- Loss of approximately 2.6 hectares of recently quarried ground
- Establishment of approximately 4.0 hectares of improved agricultural grasslands

4.3.3 Direct Impacts

From an ecological standpoint, most of the application area (over 90%) has already been negatively impacted by quarrying activities. Much of the site is either bare of vegetation or has sparse vegetation cover and, within the site boundary, the only remaining natural habitat is the boundary hedgerow.

The following impacts will arise during the backfilling and restoration work at the application site:

a) Hedgerows
There will be no significant impact on the sections of perimeter hedgerow since these are being retained and will be incorporated into the restoration scheme for the quarry site. It is possible that placement and compaction of inert soils in close proximity to hedgerows may temporarily and locally reduce potential foraging and shelter habitat for both mammals and birds.

b) Scrub Area
Some existing areas of scrub in and around the quarry will be completely destroyed by the proposed backfilling and restoration of the quarry, but other areas will remain unaffected. Removal of scrub will result in the loss of any flora and disturbance of any fauna that have colonised these areas.

c) Quarry Void, Exposed Calcareous Rock and Recolonising Bare Ground
The objective in backfilling the existing quarry void is to restore much of the application site to that ground level which existed before quarrying commenced at the site. This activity will therefore result in the burial and/or disappearance of most of those areas which have been created by quarrying activities.

As backfilling works are completed, the site will be progressively restored to agricultural pasture lands. This will be in keeping with the surrounding area which is composed predominately of improved agricultural land. The expected ecological diversity of the restored site is likely to be low, similar to that of the surrounding, intensively farmed lands.

The arable farmland which is located within and immediately beyond the boundary of the application site will not be directly affected by the proposed waste recovery activities.

4.3.4 Indirect Impacts

Dust deposition could occur as an indirect impact of the placement, spreading and compaction of naturally occurring inert materials. This could potentially have a negative impact on flora in the area, particularly on perimeter hedgerows, if foliage were to become covered in excessive levels of dust, potentially reducing the amount of photosynthesis taking place. Given the recent quarry history at the site, noise emissions from waste recovery activities are unlikely to have any adverse impact on fauna at the site.

4.4 MITIGATION MEASURES

The floral diversity at the application site, at 65 species, is considered to be quite moderate, but is nonetheless greater than would be found in the adjoining intensively farmed arable land. The majority of species are associated with the perimeter hedgerows.

Other common floral and faunal elements, because of their widespread distribution, are likely to occur at times, or in the case of some birds and mammals occasionally visit the site. Although other plant and animal species could be added to the inventory of identified species by surveying at other times, this is considered unnecessary given the existing scale of disturbance on the site.

Apart from Peregrine Falcon (*Falco peregrinus*), all the plant and animal species identified at the application site are common throughout Ireland and in the general area. No protected, endangered or rare species, other than Peregrine Falcon (*Falco peregrinus*), were found on the site.

It is recommended that the following program of mitigation measures be implemented to eliminate and minimise the impact of the development on the flora and fauna of the site over the operational life of the proposed waste recovery facility:

i. a suitable roosting and nesting area for the Peregrine Falcon should be retained on one area of the existing cliff face so as to provide a suitable roosting and nesting area.

ii. when the level of backfilling approaches that of the surrounding land, layers of subsoil should be deposited followed by a final layer of organic, well drained topsoil. The topsoil should be seeded with a suitable grass seed mix to produce pasture. This will serve to stabilise the soil surface and prevent excessive soil erosion and wash-out of fines;

iii. in order to retain landscape connectivity and minimise loss of potential nesting sites for birds, existing boundary hedgerows should be retained. Retention of boundary hedgerows will also serve as a visual and acoustic barrier;

iv. to ensure the continued biodiversity of boundary hedgerows, backfilling and restoration operations in close proximity to existing hedgerows should also be of minimum duration possible;

v. where removal of any shrubs or scrub within the application site is necessary, these works should take place between the months of September and March to avoid the bird nesting season;

vi. if and where practicable, the loss of internal shrubs or hedgerows within the site should be compensated by re-planting following restoration of site to pre-extraction ground levels. Any new planting should comprise a mixture of native tree and shrub species consistent with species readily found in the local area.

vii. the mitigation measures set out in Chapters 7 and 8 of this Environmental Impact Statement should be implemented. Dust and noise emissions from the application site will comply with the recommended DoEHLG (2004) and EPA (2000) emission limit values. Implementation of these measures shall ensure that there will be minimal adverse indirect noise and dust impacts on flora and fauna arising from backfilling and site restoration activities.

viii. following the completion of backfilling operations, the application site will be restored to agricultural use. This will ensure that land use at the site is in keeping with the character of the surrounding area.

Provided that all the mitigation measures proposed above are implemented, the overall impact of the proposed development on flora and fauna from an ecological standpoint is assessed to be a *minor negative* impact over the operational phase.

In the longer-term, after completion of backfilling activities, the overall impact of the scheme is assessed to be a *neutral* impact.

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APPENDIX 4.1

INVENTORY OF FLORA AND FAUNA

Flora and fauna lists from the application area based on a survey undertaken on 15th May 2008.

Plants (Flora)

A total of 65 plant species were recorded across the entire application site.

Field Maple	Acer campestris
Sycamore	Acer pseudoplatanus
Yarrow	Achillea millefolium
Grey Alder	Alnus incana
Scarlet Pimpernell	Anagallis arvensis
Kidney Vetch	Anthyllis vulneraria
Bur Chervil	Anthriscus caucalis
Cow Parsley	Anthriscus sylvestris
Columbine	Aquilegia sp. (cultivar)
Thrift	Armeria sp. (cultivar)
Daisy	Bellis perennis
Mustard	Brassica sp.
Butterfly-bush	Buddleja davidii
Hedge Bindweed	Calystegia sepium
Common Knapweed	Centaurea nigra
Spear Thistle	Cirsium vulgare
Hazel	Corylus avellana
Cotoneaster	Cotoneaster sp.
Hawthorn	Crataegus monogyna
Leyland Cypress	Cupressocyparis leylandii
Great Willowherb	Epilobium hirsutum
Field Horsetail	Equisetum arvense
Sun Spurge	Euphorbia helioscopia
Ash	Fraxinus excelsior
New Zealand Broadleaf	Griselinia littoralis (cultivar)
Ivy	Hedera helix
Hogweed	Heracleum sphondylium
Hawkweed	Hieracium sp. (aggregate)
Oxeye Daisy	Leucanthemum vulgare
Common Bird's-foot-trefoil	Lotus corniculatus
Scentless Mayweed	Matricaria perforata
Daffodil	Narcissus sp. (cultivar)
Common Poppy	Papaver rhoeas
Hart's-tongue Fern	Phyllitis scolopendrium
Norway Spruce	Picea abies
Ribwort Plantain	Plantago lanceolata
Poplar	Populus sp.
Creeping Cinquefoil	Potentilla reptans
Primrose	Primula vulgaris
Cherry	Prunus sp. (cultivar)
Bracken	Pteridium aquilinum
Meadow Buttercup	Ranunculus acris
Creeping Buttercup	Ranunculus repens
Weld	Reseda luteola
Bramble	Rubus fruticosus
Common Sorrel	Rumex acetosa
Willow	Salix sp. (aggregate)
Elder	Sambucus nigra
Common Ragwort	Senecio jacobaea
Groundsel	Senecio vulgaris
Alexanders	Smyrnium olusatrum
Smooth Sow-thistle	Sonchus oleraceus
Rowan	Sorbus aucuparia
Comfrey	Symphytum sp. (cultivar)
Lilac	Syringa vulgaris
Dandelion	Taraxacum sp. (aggregate)

Hop Trefoil	Trifolium campestre
Red Clover	Trifolium pratense
White Clover	Trifolium repens
Colt's-foot	Tussilago farfara
Gorse	Ulex europaeus
Common Nettle	Urtica dioica
Germander Speedwell	Veronica chamaedrys
Bush Vetch	Vicia sepium
Periwinkle	Vinca sp. (cultivar)
Common Dog-violet	Viola riviniana

Aviformes (Birds)

A total of 16 bird species were recorded from the entire application site. Some other common species of bird species could be expected to occur at times on the site.

The following species of birds were recorded on the site and their status in Ireland is indicated as follows:- R = resident, B = breeding, M = migratory.

Entire Application Area (16 species)

Blackbird	Tudus merula	R & B
Blue Tit	Parus caeruleus	R & B
Collared Dove	Streptopelia decaocto	R & B
Dunnock	Prunella modularis	R & B
Jackdaw	Corvus monedula	R & B
Magpie	Pica pica	R & B
Peregrine	Falco peregrinus	R & B
Pheasant	Phasianus colchicus	R & B
Robin	Erithacus rubecula	R & B
Rook	Corvus frugilegus	R & B
Sand Martin	Riparia riparia	M & B
Song Trush	Turdus philomelos	R & B
Swallow	Hirundo rustica	M & B
Willow Warbler	Phylloscopus trochilus	M & B
Wood Pidgeon	Columba palumbus	R & B
Wren	Troglodytes troglodytes	R & B

Mammals

Brown Rat	Rattus norvegicus
Mountain or Irish Hare	Lepus timidus
Fox	Vulpes vulpes

Insects – Butterflies (Lepidoptera)

Green-veined White	Pieris napi
Holly Blue	Celastrina argiolus
Orange Tip	Anthocaris cardamines
Speckled Wood	Pararge aegeria

SECTION 6: WATER

6.1 INTRODUCTION

SLR Consulting Limited (SLR) has been appointed by Roadstone Dublin Ltd. to undertake a hydrogeological and hydrological impact assessment for the backfilling and restoration of a limestone quarry at Milverton, County Dublin using imported inert soil.

This section details the local hydrology and hydrogeology of the application site and surrounding area (up to 4km radius around the site boundary) and identifies potential hydrogeological and hydrological impacts associated with the proposed development.

Unmitigated impacts, assuming that no mitigation is in place for the initial assessment, are considered before discussing appropriate mitigation measures and reassessing potential impacts. The assessment is based on a detailed baseline description of the local geological, hydrological and hydrogeological regimes.

6.1.1 Background

Extraction of limestone rock and associated production of construction materials was suspended at Milverton in late summer 2008. The proposal to restore the quarry by importing inert soils to substantially backfill the existing quarry void to its original ground level is technically classified as recovery of waste through deposition on land. The large volume of imported inert soil and stone required to complete this task requires a Waste Licence Application to be submitted to the Environmental Protection Agency, together with a supporting Environmental Impact Statement.

This chapter presents an assessment of the environmental impact of the restoration of the site using inert soil and stones on the hydrogeological and hydrological environment. Further information on the waste types and proposed waste recovery facility is provided in Chapter 2 of this EIS.

6.1.2 Scope of Work

This chapter identifies the local hydrogeological and hydrological environment based on available information in the vicinity of the site. A qualitative assessment has been undertaken of the potential impacts on this environment arising from backfilling of the limestone quarry using inert materials. The assessment considers the proposed phasing of the infilling, the waste types and any proposals for water management at the site. The methodology of the assessment is described in detail in Section 6.3.1.

6.1.3 Sources of Information

The following sources of information have been consulted in order to investigate the hydrogeology and hydrology of the area surrounding the application site:

- The Environmental Protection Agency for Ireland website (www.epa.ie) for maps and environmental information;
- Geological Survey of Ireland website (www.gsi.ie);
- Geology of Meath, Sheet 13, 1:100,000 scale, Geological Survey of Ireland, 1999;
- Groundwater Protection Schemes, Department of the Environment and Local Government, Environmental Protection Agency, and Geological Survey of Ireland, 1999, and Appendix Groundwater Protection Response for Landfills; and
- Bog of the Ring Groundwater Source Protection Zones, GSI, 2005

6.1.4 Contributors

This study of surface water and groundwater was undertaken and prepared by:

Les Brown, B.Sc., M.Sc. Ph.D., Hydrogeologist, SLR Consulting Ireland

6.2 RECEIVING ENVIRONMENT

6.2.1 Available Information : Geology and Soils

A detailed description of the local and regional soil, subsoil and bedrock geology is provided in Section 5. A summary is provided below

Soils and Subsoils
The Environmental Protection Agency (EPA) website publishes soils and subsoils maps created by the Spatial Analysis Unit, Teagasc in collaboration with the Geological Survey of Ireland. These maps indicate that the majority of the site is underlain by shallow well drained mineral soils, which are classified as grey brown podzolics. These soils are derived from the underlying glacial till which extends across the region. The glacial till is derived from limestone and shale parent material (refer to Figure 5.1 in Chapter 5 of this EIS).

Solid Geology
The superficial deposits under the entire site and surrounding area are underlain by bedrock of the lower Carboniferous Holmpatrick Formation (refer to Figure 5.2 in Chapter 5 of this EIS). The Holmpatrick Formation forms part of the Milverton Group and comprises well-bedded bioclastic limestones.

Local Geology
Three groundwater monitoring wells (designated BH01, BH02 and BH03) were installed across the application site in December 2008. The location of these monitoring wells is shown in Figure 6.1. The monitoring wells were constructed using rotary drilling techniques, and therefore only general descriptions were obtained of bedrock encountered. As the boreholes were drilled within the quarry area where the subsoil had been stripped, they did not encounter soil and subsoil. However, BH03, encountered 13m of Made Ground and glacial till (described as sandy gravelly clay) before encountering rock head. The boreholes were drilled to a final depth of between 21m and 30m. Groundwater monitoring piezometers were installed so that the specified response zones were isolated from other water ingress. The materials encountered during drilling have been described as follows:

- MADE GROUND (Sandy gravelly clay);
- Sandy gravelly CLAY (Glacial Till)
- Grey fine to medium grained LIMESTONE

The well construction records are presented in Appendix 6.1

6.2.2 Available Information : Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability
The site is located within the Lusk Groundwater Body (GWB), which extends from Dunshaughlin in Meath to the North Dublin coast. The Lusk GWB includes the Bog of the Ring groundwater supply that abstracts a yield of 4ML/d from the Calp Limestone. The outer limit of the source protection zone for the Bog of the Ring lies 4km away from Milverton quarry in a westerly direction.

The bedrock at Milverton is limestone of the Holmpatrick Formation. As is typical of bedrock in the region, groundwater flow is controlled by secondary fissure permeability. The Holmpatrick Formation is classified by the GSI (GSI, 2005) as locally important karstified bedrock (Lk), as indicated on Figure 6.2. The bulk permeability of the formation is low, with groundwater storage and movement mainly constrained to the upper weathered horizons of this unit and fractures / faults. Based on a review of the GSI karst database, there are no karst landforms or caves within 1km of the application site. The nearest recorded karst landforms are two springs, both of which are located 2km to the west.

The Quaternary deposits that overlie the bedrock tend to be relatively thin but play an important role in groundwater recharge. Where Quaternary deposits comprise sand and gravel, they allow a high level of recharge and can provide additional storage to the underlying bedrock aquifer. In this region, the extent and thickness of sand and gravel deposits is insufficient for them to be considered an aquifer in its own right.

Groundwater vulnerability maps published on the EPA website indicate that the site is located in an area with high to extreme Groundwater Vulnerability status. An extract of the Groundwater Vulnerability map is presented as Figure 6.3. The groundwater vulnerability reflects the potential for rapid groundwater movement through the quaternary deposits into the underlying bedrock aquifer.

The excavation has intersected the groundwater table and had sequentially lowered it around the periphery of the excavation with each quarry bench. There are minor groundwater inflows to the quarry that drain to the floor, where they are contained. Water is pumped from the quarry floor as and when required in order to maintain dry conditions on the floor. When active, the pumps have an estimated discharge rate of 5l/s.

Recharge Mechanisms
The published geological memoir reports that the rainfall in the area is around 900mm/year. Potential recharge to the aquifer ranges from 325mm/yr to 550 mm/yr. The bulk of this recharge occurs between late October and early March.

Groundwater Levels and Flow
The published geological memoir reports that in this region of Ireland, groundwater is generally within 10m of the surface and has an annual fluctuation of less than 5m.

During the groundwater well installation works in December 2008, groundwater strikes were recorded in each well during drilling. A summary of water strikes is presented in Table 6.1 below:

Borehole Name	Water Strike (mbgl)	Water Strike (mOD)	Well depth (m)	Deposits recorded at water strike
BH01	18	-3	21	Grey fine grained LIMESTONE
BH02	19	0.5	30	Grey fine grained LIMESTONE
BH03	18	8	24	Grey fine grained LIMESTONE

Table 6.1. Groundwater Strikes Recorded during Drilling

Water levels were recorded on the 8th January 2009 (approximately three weeks after the completion of drilling) and are detailed below:

- BH01 – -0.7mOD (14.3mbgl)
- BH02 – 15.2mOD (10.8mbgl)
- BH03 – 7.2mOD (12.2mbgl)

Groundwater contours based on the rest levels recorded in the groundwater monitoring wells have been used to determine groundwater flow contours, which are presented on Figure 6.4. These data indicate that the indicative groundwater flow direction is across the site, from north to south. These data indicate that the quarry floor (at -12m AOD) is 27m below the groundwater table at the northern part of the excavation and 17m below the water table at the southern end of the excavation.

Groundwater Abstractions, Use and Quality
The GSI records two existing wells within 1km of the site boundary. Both wells are located within the Holmpatrick Formation, to the south of the site within the townland of Loughland. These wells service residences that lie along the local road between Baldongan townland and Skerries. All other local residences are connected to mains water.

Abstractions for the aggregate washing and processing at the site had historically been sourced from sumps on the quarry floor. These sumps continue to be pumped to maintain dry conditions on the quarry floor. It is estimated that approximately 5l/s (100m^3/day) is pumped from the site to maintain a dry quarry floor.

Samples were obtained from BH01, BH02 and BH03 in January 2009 for hydrochemical analysis. All wells were purged prior to sampling. Additionally, a water sample was collected from the

surface watercourse to the west of the site, adjacent to the R127 Regional Road. All samples were sent to an independent accredited laboratory for analysis. A summary of water quality test parameters is presented in Table 6.2 below:

Parameters	Sampling Locations				EU Drinking Water Standard (98/83/EC)
	BH01	BH02	BH03	SW01	
Field Tests					
Temperature ℃	9.8	10.6	10.48	1.33	-
Conductivity µS/cm	739	943	968	300	2500
pH	7.89	7.42	7.61	8.59	2500
Dissolved Oxygen	9.28	6.77	6.81	14.94	-
Laboratory Tests					
Total Hardness (mg/l)	242	234	318	354	-
Total Alkalinity (mg/l)	270	230	250	300	-
TOC (mg/l)	4	3	3	-	No absolute change.
BOD (mg/l)	-	-		4	-
DRO (µg/l)	-	-	-	<10	-
PRO (µg/l)	-	-	-	<10	-
Mineral Oil (µg/l)	-		-	<10	-
Benzene (µg/l)	-	-	-	<10	-
Toluene (µg/l)	-	-	-	<10	-
Ethylbenzene (µg/l)	-	-	-	<10	-
Total Xylene (µg/l)		-	-	<10	-
Dissolved Sodium (mg/l)	61.9	19.5	42.6	21.9	200
Dissolved Potassium (mg/l)	3.9	8.8	10.8	2.7	12
Dissolved Calcium (mg/l)	67.52	70.80	93.10	119.3	-
Dissolved Iron (ug/l)	47	51	41	40	200
Dissolved Magnesium (mg/l)	17.78	13.89	20.78	13.69	-
Dissolved Manganese (ug/l)	11	19	13	<1	50
Chloride (mg/l)	30	29	94	50	250
Ammoniacal-N (mg/l)	<0.2	<0.2	0.2	<0.2	-
Nitrite (mg/l)	0.27	0.23	0.36	0.11	0.5
Nitrate (mg/l)	38.4	16.9	21.8	45.3	50
Sulphate (mg/l)	54	18	79	62	250
Phosphate (ortho) (mg/l)	0.04	1.18	0.07	0.07	-

KEY: Shaded = maximum admissible concentration exceeded

Table 6.2 Summary of Groundwater Quality

The groundwater quality is considered to be good. All parameters analysed had ion concentrations lower than the EU Drinking Water Standard. Although the water quality for the surface water course opposite the quarry entrance does not exceed the Maximum Admissible Concentration (MAC), the recorded concentration of nitrate is particularly high at 45.3mg/l. Additional List I analyses for Diesel and Petrol Range Organics, Mineral Oils, Benzene, Toluene, Ethylbenzene and Total Xylene, were carried out on the sample obtained from the surface water stream, none of which were detected.

The hydrochemistry of the groundwater samples indicate hard calcium-type water with moderately low sodium and magnesium. This type of water is typical of groundwater from a limestone aquifer. Potassium, chloride, ammoniacal nitrogen, nitrite and nitrate are moderate indicating minimal organic contamination. The higher nitrate level at BH01, although still low, is most likely due to its closer proximity to agricultural land. There are a small number of hydrochemical variations between samples taken up gradient and down gradient of the quarry. However these are within the normal expected range for this type of aquifer.

Groundwater Protection
Groundwater in Ireland is protected by European Community and national legislation. The Geological Survey of Ireland (GSI) in conjunction with the Department of Environment and Local Government (DoELG) and the EPA have developed a methodology for the preparation of groundwater protection schemes to assist the statutory authorities and others to meet their responsibility to protect groundwater (DoELG / EPA / GSI, 1999). This methodology incorporates land surface zoning and groundwater protection responses.

The DoELG / EPA / GSI has developed a scheme (Groundwater Protection Response Matrix for Landfills) to assessing potential landfill sites on the basis of groundwater vulnerability and aquifer status. However, it should be noted that this scheme has largely been developed for new non-hazardous landfills and is therefore not an appropriate tool for assessment of inert soil recovery facilities such as that at Milverton.

Notwithstanding this, review of the Groundwater Vulnerability Map (Figure 6.4) and the Aquifer Map (Figure 6.3) in accordance with the DoELG / EPA / GSI methodology indicates that the Milverton site is located within an area of High Vulnerability and a Locally Important Karstified Bedrock Aquifer. These classifications have been compared against the matrix for non hazardous landfills; which indicates that the site setting falls within a response category of R3[1], which is described as being 'Not generally acceptable (for non-hazardous landfills), unless it can be shown that :

- The groundwater in the aquifer is confined; or
- There will be no significant impact on the groundwater; and
- It is not practicable to find a site in a lower risk area'.

Given that site backfilling and restoration activities (such as those envisaged for this site) can only be undertaken where previous activities have created void space in the landscape, the requirement to identify other sites in lower risk areas does not apply. The proposed backfilling of the existing quarry using predominantly cohesive inert glacial till will provide an enhanced degree of protection, over and above that which exists at present.

Given the limited risk to groundwater associated with the placement and compaction of inert soil and stones compared to those presented by non-hazardous landfills, it is considered that the site setting is appropriate for an inert soil recovery facility. It is also reiterated that the DoELG / EPA / GSI groundwater protection methodology has not been developed for inert recovery facilities. Further to this, the significance of the impact of the development on groundwater is fully explored in Section 6.3 of this EIS Chapter.

6.2.3 Available Information : Hydrology

Local Hydrology and Surface Water Quality
The nearest watercourse to the site is the small stream adjacent to the quarry entrance. This watercourse is a tributary of the Mill Stream that discharges to the Irish Sea at Skerries. Ordnance Survey mapping indicates that the Mill stream has its headwaters in the Baldongan and Balcunnin townlands approximately 2km south-west of the application site. The EPA does not maintain a record of water quality in this stream.

Two water samples were taken from the tributary of the Mill Stream on 26th November 2010, one upstream from the site (SW1) and one downstream from the site (SW2), at the discharge point. There was no discharge from the quarry to the stream at the time the samples were taken. The test results are presented in Appendix 6.2 attached.

The sample results indicate that water in the stream is generally of good quality, with some suspended solids. The slightly elevated chloride in the stream is likely to be associated with the coastal location of the catchment and the elevated nitrates most likely reflect runoff from agricultural lands in the catchment. The elevated Phosphorus levels in the stream most likely reflect human activities in the catchment.

A water sample (D1) was also taken from the quarry sump on the same day. This sample is deemed to be characteristic of water likely to be discharged from the quarry floor to the tributary of the Mill Stream. These tests results are also presented in Appendix 6.2.

The water quality test results indicate that the ponded water on the floor of the quarry is of good quality with slightly elevated chloride (associated with the coastal location) and elevated nitrates (reflecting runoff from agricultural lands immediately up-gradient of the quarry). The low phosphorus levels, below the laboratory detection level, in the sample indicate no human impacts on the water quality in the quarry void. There were no hydrocarbons recorded in the sample.

Surface Water Flows and Discharges
The EPA website indicates that there are no hydrometric stations within 5km of the site, and therefore no flow statistics are available for the watercourses close to the site. A summary flow report for the Mill Stream at the discharge point was generated using the EPA Hydro Tool for flow estimation in ungauged catchments, a copy of which is included in Appendix 6.3. The flow report indicates that the 50%ile flow in the stream is approximately 0.062m^3/sec while the 95%ile flow is estimated to be 0.028m^3/sec based on a catchment area of 8.2km^2. There is currently no information or record of abstraction or discharge consents in the vicinity of the site.

At the present time, surface water and groundwater ingress collecting on the quarry floor is collected in a sump at a low point on the quarry floor and pumped via flexible pipework and buried drainage infrastructure to the tributary of the Mill Stream a short distance beyond the north-eastern corner of the quarry, as indicated on Figure 6.4.

The discharge to the tributary of the Mill Stream largely comprises surface water run-off into the quarry void. There is relatively little groundwater ingress through the limestone faces. This is evidenced by the relatively low level of water currently ponding on the floor of the quarry even though it lies below sea level (at-9.5mOD) and has not been pumped since rock extraction and pumping from the quarry floor were both suspended in summer 2008.

The rate, timing and volume of discharge from the sump in the quarry floor to the tributary of the Mill Stream is controlled by precipitation patterns over the quarry footprint. For a quarry void of approximately 5.41 hectares, with an annual average rainfall of 802mm/year and assuming zero evapotranspiration (on account of absence of vegetation), the average run-off volume, and volume discharged to the stream is approximately 119m^3/day or 1.38litres/sec. In practice, the discharge volume will vary between 0litres/sec when no rain falls and approximately 15.7litres/sec during a 1 in 50 year storm event (50mm rainfall in 48hours).

Flooding
The Office of Public Works website (www.floodmaps.ie) indicates that there are two records of historic flooding recorded in the vicinity of the site, one in November 1982 and one in August 1986. Both reported flood incidents occurred 400m north of and down hydraulic gradient of the site. The proposed development is not considered to be at risk of flooding. Surface water run-off and discharges at site are, and will continue to be managed so that they do not increase the risk of flooding in the vicinity of the application site.

6.2.4 Field Surveys

Site visits were undertaken by a senior SLR hydrogeologist between the 1st and 12th December 2008 (during the monitoring well installation works). In the course of these visits, some minor groundwater inflows into the quarry were observed from fractures. However, these only occurred

at approximately 10mOD and only on the northern quarry face. Photographs of the features of note at the site are presented as plates at the end of this Chapter.

6.2.5 Limitations

The assessment is based on visual observations from site visits, available published information, and discussions on site and is a qualitative assessment.

6.3 IMPACT OF THE REMEDIATION WORKS

6.3.1 Evaluation Methodology

The impact of the proposed development (as detailed in Chapter 2) are assessed in this section. The methodology applied in the assessment is a qualitative risk assessment methodology in which the probability of an impact occurring and the magnitude of the impact, if it were to occur, are considered. This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the development. This approach allows effort to be focused on reducing risk where the greatest benefit may result. The assessment of risk is outlined in Table 6.3 overleaf.

Probability of Occurrence	**Magnitude of Potential Impacts**			
	Severe	Moderate	Mild	Negligible
High	High	High	Medium	Low
Medium	High	Medium	Low	Near Zero
Low	Medium	Low	Low	Near Zero
Negligible	Low	Near Zero	Near Zero	Near Zero

Table 6.3 : Matrix Used to Assess Potential Impacts

The magnitude of potential impacts in relation to geology, hydrogeology and hydrology are detailed in Table 6.4 overleaf :

Magnitude	Potential Impact
Negligible	No impact or alteration to existing important geological environs or important soil settings (i.e. valuable agricultural land) No alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; No alteration to groundwater recharge or flow mechanisms; and No pollution or change in water chemistry to either groundwater or surface water.
Mild	Some loss of important soils or peat, but which has no long term impact Minor or slight changes to the watercourse, hydrology or hydrodynamics; Changes to site resulting in slight increase in runoff well within the drainage system capacity; Minor changes to erosion and sedimentation patterns; and Minor changes to the water chemistry.
Moderate	Slope failure or instability which may cause foundation problems, loss of extensive areas of important soils or peat, damage to important geological structures / features Some fundamental changes to watercourse, hydrology or hydrodynamics; Changes to site resulting in an increase in runoff within system capacity; Moderate changes to erosion and sedimentation patterns; and Moderate changes to the water chemistry of surface runoff and groundwater.
Severe	Slope failure or instability which results in loss of life, permanent degradation and total loss of peat environment across the entire development site, loss of important geological structure/feature. Wholesale changes to watercourse channel, route, hydrology or hydrodynamics; Changes to site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; and Major changes to the water chemistry or hydro-ecology.

Table 6.4 : Magnitude of Potential Geological, Hydrological and Hydrogeological Impacts

In addition to their nature and significance, the potential impacts will be assessed in terms of their duration, whether they are direct or indirect impacts, and also if the impact will be cumulative.

The following sections identify the potential impacts of the proposed development on the geological, hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with Tables 6.3 and 6.4. It should be noted that the impacts are initially assessed with no mitigation or design measures incorporated to reduce the risk.

6.3.2 Potential Impacts on Geology

Given the geological setting of the proposed development, (i.e. an existing limestone quarry) and the type of the proposed development (i.e. backfilling the pit with inert wastes, specifically inert soil and stones and recovered secondary aggregate), it is considered that there is a negligible potential impact on the geological environment associated with developing the site. The area of the site is small compared to the local and regional extent of the limestone bedrock.

6.3.3 Potential Impacts on Groundwater

Given the hydrogeological setting, it is considered that the proposed development has the potential to impact on groundwater in terms of both the groundwater quality and the groundwater flow regime. These are considered separately below.

Groundwater Quality
During the development and operation of the site there is a risk of groundwater pollution from the following potential sources:

- accidental spillage of fuels and lubricants by construction plant placing the inert fill and other operational procedures;
- increase in suspended solids and potential for contaminated runoff entering groundwater during development of the site; and
- rogue loads of contaminated material being deposited at the site.

It is considered that without mitigation the probability of occurrence of spillage of fuels, lubricants and other potentially contaminative liquids is 'medium' due to the area of the site and number of vehicles that will be using the site and the magnitude of impact is 'moderate'. Therefore the overall risk to groundwater, without mitigation, is '*medium*'.

It is considered that without mitigation the probability of occurrence of an increase in suspended solids and potential for contaminated runoff entering groundwater during operation of the facility is 'medium' to 'high' due to the time frame over which this may occur and the potential for infiltrating rainfall to mobilise fines in loose backfilled materials and carry them into the groundwater body (much of the imported fill will be high in silt / clay content). The magnitude of impact is 'moderate' and therefore the overall risk is '*medium*' to '*high*'.

Without mitigation the probability of occurrence of a rogue load which may have the potential to contaminate groundwater at the site is 'medium' and the magnitude of impact is 'mild' to 'moderate' depending on where the rogue load is deposited. The overall impact is considered to be '*low*' to '*medium*'.

Groundwater Flow
Without mitigation, or consideration of operational procedures, infilling the site with low permeability inert fill material has the potential to create a low permeability zone. This could alter the groundwater flow pattern around the site, leading to higher groundwater levels upstream of the site and lower levels downstream of the site. Without mitigation the probability of occurrence is 'moderate' due to the thick unsaturated zone of the aquifer.

Is noted that (a) the regional permeability of the unsaturated zone of the aquifer is moderately high which will maintain regional groundwater flow direction, and (b) runoff shed from the proposed restoration landform will infiltrate to form groundwater recharge on the downstream site boundary which will maintain aquifer recharge. The overall impact is therefore considered to be '*low*'.

6.3.4 Potential Impacts on Surface Water

The annual average discharge of approximately 1.38litres/sec (0.0013m^3/sec) from the quarry accounts for approximately 2% of the estimated 50%ile flow in the stream and 5% of the estimated 95%ile flow (assessed using the EPA Hydro Tool). It is therefore considered that the resumption of quarry discharge will have no significant adverse impact on flows in the tributary of the Mill Stream.

There are no surface water features within the site boundary and limited artificial features such as temporary channels, sumps and/or ponds required for surface water management. It is considered that the potential impact of backfilling the worked out quarry with inert fill in the short to medium term could have a potentially *moderate* to *high* impact on surface water in the area if suspended soil particles in surface water run-off collecting in sumps and/or closed depressions is pumped through pipelines and/or existing buried drains to the tributary of the Mill Stream watercourse beyond the north-eastern site boundary.

In the longer term, it is likely that much of the run-off from the completed landform will generally recharge to ground within the site boundary. Some run-off collecting in the closed depression in front of the rock face will however fall via a gravity drain toward the watercourse beyond the northern site boundary and could potentially carry some suspended solids. This is considered to be a potentially *moderate* impact.

6.3.5 Summary of Potential Impacts

A summary of potential impacts *without mitigation* is presented in Table 6.5 below:

Potential Impact	Spatial Impact, Duration, Direct/Indirect	Probability of Occurrence	Magnitude of Impact	Significance of Impact	Mitigation Required?
Groundwater Quality					
Fuel Spillages	Local, Short Term, Direct	Medium	Moderate	Medium	Yes
Release of suspended solids	Local, Long Term, Direct	Medium to High	Moderate	Medium to High	Yes
Rogue load of contaminated material	Local, Short Term, Direct	Medium	Mild to Moderate	Low to Medium	Yes
Groundwater Flow/Recharge to Aquifer					
Impermeable barrier to groundwater flow	Local, Long Term, Direct	High	Moderate	Low	No
Reduction in recharge to aquifer	Local, Long Term and Direct	High	Moderate	High	Yes
Surface Water Quality					
Release of suspended solids	Local, Short and Long Term, Direct	Medium to High	Moderate	Medium to High	Yes

Note: it is considered that the potential impacts on the surface water from the development is negligible and is therefore not detailed in this table.

Table 6.5 Summary of Unmitigated Risk and Magnitude of Potential Impacts at Milverton

Review of Table 6.5 indicates that if no mitigation measures are incorporated into the quarry backfilling operation, there is potential for the site to cause detrimental and direct impacts to the superficial aquifer by locally polluting groundwater and creating a low permeability zone to groundwater flow. The impacts are all local, but range from short-term to long-term. It is considered that if the identified potential impacts on either groundwater quality or groundwater flow were all to occur there would be a cumulative effect, which would increase the significance of the impact.

Similarly, in the absence of a functioning surface water management system, the quarry backfilling operation at the site has the potential to cause detrimental and direct impacts to the existing watercourse beyond the northern site boundary.

It is therefore recommended that the mitigation measures outlined in the following section are incorporated to reduce the potential impact.

6.3.6 Do Nothing Scenario

Were the proposed backfilling of the application site not to proceed as envisaged, it is unlikely that a portion of the land at least could ever be put to productive use and that it would remain as a scar on the landscape. Ongoing vigilance will be required to ensure no potential contaminating activities occur on or in the vicinity of the quarry floor.

6.4 MITIGATION MEASURES

Proposed mitigation measures required to reduce the potential impacts to acceptable levels are identified in this section. These measures either reduce the likelihood of an event occurring, or reduce the magnitude of the consequences if the event does occur. It should be noted that

several of the mitigation measures proposed would have a positive effect on more than one potential impact.

6.4.1 Proposed Mitigation Measures

In order to mitigate against the risk of pollution to groundwater and surface water occurring during operation of the site, the following management measures would be included:

- wherever possible a traffic management system would be put in place to reduce the potential conflicts between vehicles, thereby reducing the risk of a collision;
- a site speed limit would be enforced to further reduce the likelihood and significance of collisions;
- all plant would be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids/liquors;
- refuelling of vehicles would either be undertaken in a surfaced compound area from a fuel tank(s) that is bunded or be undertaken off-site to minimise the risk of uncontrolled release of polluting liquids/liquors;
- maintenance of plant and machinery would be undertaken within a site compound area or off-site, as appropriate, to minimise the risk of uncontrolled release of polluting liquids;
- spill kits would be made available on-site to stop the migration of spillages, should they occur;
- the ponded areas on the pit floor should be drained prior to the waste being deposited to minimise the mobilisation of fines,
- waste loads should be inspected and tested to confirm they are inert prior to deposition at site.
- diverting all surface water run-off collected in sumps via settlement ponds and/or interceptor tanks prior to discharge to surface watercourses in order to reduce concentration of suspended solids.

It is further envisaged that the quality of the surface water discharging from the settlement ponds will be monitored prior to being discharged via the existing buried discharge pipe to the tributary of the Mill Stream. The parameters to be monitored will include physical parameters (temperature, pH, dissolved oxygen, electrical conductivity, suspended solids, visual/odour), chemical parameters (nitrate, ammoniacal nitrogen, chloride, sulphate, dissolved metals, non-metals, total hydrocarbons and List I/II substances) and biochemical oxygen demand (BOD).

These measures would reduce the potential impact of

(I) spillage of fuels and lubricants from '*medium*' to '*low*',
(II) an increase in suspended solids from '*medium to high*' to '*low'* and
(III) contamination from rogue loads from '*low to medium*' to '*near zero*'.

6.4.2 Residual Impacts

A summary of the proposed mitigation methods, together with the predicted effects and residual impacts is presented in Table 6.6 overleaf.

Examination of Table 6.6 confirms that there are no significant residual impacts with respect to groundwater and/or surface water provided the appropriate mitigation measures are undertaken. It is therefore considered that the siting of an inert recovery facility in this location is acceptable and it has been shown that there will be no significant impact on groundwater and/or surface water.

6.5 INTERACTIONS

It is considered that the groundwater and surface water are not interconnected, and that the Mill Stream is not in continuity with groundwater at the application site. Groundwater at site drains south eastwards from the site towards the Irish Sea. There are presently surface water discharges from the site and these will be maintained during the backfilling of the quarry void as and when required.

Potential Impact	Spatial Impact, Duration, Direct/Indirect	Probability of Occurrence	Magnitude of Impact	Significance of Impact	Mitigation Required?	Mitigation Measures	Mitigated Probability of Occurrence	Mitigated Magnitude of Impact	Residual Magnitude of Impact
Groundwater Quality									
Spillages of fuel	Local, Short Term, Direct	Medium	Moderate	Medium	Yes	Traffic systems, maintenance, bunding and spill kits	Low	Moderate	Low
Release of suspended solids	Local, Long Term, Direct	Medium to High	Moderate	Medium to High	Yes	Minimisation, management, and waste deposition measures	Low	Moderate	Low
Rogue load of contaminated material	Local, Short Term, Direct	Medium	Mild to Moderate	Low to Medium	Yes	Inspection and testing of waste loads	Negligible	Low to Medium	Near Zero
Groundwater Flow / Recharge to Aquifer									
Impermeable barrier to groundwater flow	Local, Long Term, Direct	High	Moderate	Low	No				
Reduction in recharge to aquifer	Local, Long Term and Direct	High	Moderate	High	Yes	Soakaway and engineering measures	Negligible	Moderate	Near Zero
Surface Water Quality									
Release of suspended solids	Local, Short and Long Term, Direct	Medium to High	Moderate	Medium to High	Yes	Surface water management measures	Low	Moderate	Low

Table 6.6 Summary of Mitigation and Residual Impacts at Milverton

ALcontrol Laboratories

Unit 18A
Rosemount Business Park
Ballycoolin
Dublin 11
Tel : (0035) 3188 29893

SLR Consulting Ireland
CSA House
Unit 7
Dundrum Business Park
Windy Harbour
Dublin
Dublin14

Attention: Peter Glanville

CERTIFICATE OF ANALYSIS

Date:	07 December 2010
Customer:	D_SLRCON_DUB
Sample Delivery Group (SDG):	101126-59
Your Reference:	501.0180.00018
Location:	Milverton
Report No:	106949

We received 3 samples on Friday November 26, 2010 and 3 of these samples were scheduled for analysis which was completed on Tuesday December 07, 2010. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Asbestos testing - we are not accredited for screening soil samples for asbestos fibres. We are only accredited to identify asbestos fibres in bulk material (ACM).

Approved By:

Iain Swinton

Business Director - Land, UK & Ireland

UKAS TESTING
1291

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
2484902	D1			26/11/2010
2484917	SW1			26/11/2010
2484924	SW2			26/11/2010

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Test Schedule

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	2484902				2484917				2484924			
			Customer Sample Reference	D1				SW1				SW2			
			AGS Reference												
			Depth (m)												
			Container	1l glass bottle (D)	H2SO4 (Dublin)	PLAS BOT (D)		1l glass bottle (D)	H2SO4 (Dublin)	PLAS BOT (D)		1l glass bottle (D)	H2SO4 (Dublin)	PLAS BOT (D)	
Ammonium Low	All	NDPs: 0 Tests: 3			X				X				X		
Anions by Kone (w)	All	NDPs: 0 Tests: 3				X				X				X	
BOD True Total	All	NDPs: 0 Tests: 3				X				X				X	
COD Unfiltered	All	NDPs: 0 Tests: 3				X				X				X	
Colour Test	All	NDPs: 0 Tests: 3				X				X				X	
Total Dissolved Solids (Grav)	All	NDPs: 0 Tests: 3				X				X				X	
Total Metals by ICP-MS	All	NDPs: 0 Tests: 3				X				X				X	
Total Suspended Solids	All	NDPs: 0 Tests: 3				X				X				X	
TPH by IR Oils and Greases	All	NDPs: 0 Tests: 3		X				X				X			

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of the individual compounds within the samples are not corrected for this recovery.

Component	LOD/Units	Method	Customer Sample R	D1	SW1	SW2			
			Depth (m)	.	.	.			
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)			
			Date Sampled	26/11/2010	26/11/2010	26/11/2010			
			Date Received	26/11/2010	26/11/2010	26/11/2010			
			SDG Ref	101126-59	101126-59	101126-59			
			Lab Sample No.(s)	2484902	2484917	2484924			
			AGS Reference						
Dissolved solids, Total (gravimetric)	<40 mg/l	TM021		338 #	463 #	453 #			
Suspended solids, Total	<2 mg/l	TM022		<2 #	8 #	7.5 #			
BOD, unfiltered	<1 mg/l	TM045		1.43 #	1.15 #	1.11 #			
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099		0.122	0.496	0.156			
COD, unfiltered	<7 mg/l	TM107		<7 #	11.6 #	9.54 #			
Sulphate	<3 mg/l	TM184		53.7 #	60.9 #	62 #			
Chloride	<2 mg/l	TM184		37 #	37.5 #	37.6 #			
Nitrate as NO3	<0.3 mg/l	TM184		25.2 #	30.5 #	30.7 #			
Phosphorus (tot.unfilt)	<20 µg/l	TM191		<20 #	99.1 #	195 #			
TPH / Oil & Greases	<1 mg/l	TM235		<1 #	<1 #	<1 #			
Apparent Colour	<1 mg/l Pt/Co	TM261		<1	7	6.3			
True Colour	<1 mg/l Pt/Co	TM261		<1	4.32	3.65			

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Table of Results - Appendix

REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10-7

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM021	Method 2540C, AWWA/APHA, 20th Ed., 1999	Determination of total dissolved solids in waters by gravimetry.		
TM022	Method 2540D, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part120 1981;BS EN 872	Determination of total suspended solids in waters		
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM235	The Determination of Hydrocarbon Oils in Waters by Solvent Extraction, Infra red Absorption and Gravimetry 1983, HMSO, London	Determination of Total Petroleum Hydrocarbons (TPH) in Waters By Infra-Red Spectroscopy		
TM261	Colour and Turbidity of Waters, Methods for the Examination of Waters and Associated Materials, HMSO, 1981, ISBN 0 11 7519553.	Determination of True and Apparent Colour by Spectrophotometry		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	2484902	2484917	2484924
Customer Sample Ref.	D1	SW1	SW2
AGS Ref.			
Depth			
Type	LIQUID	LIQUID	LIQUID
Ammonium Low	07-Dec-2010	29-Nov-2010	07-Dec-2010
Anions by Kone (w)	29-Nov-2010	29-Nov-2010	29-Nov-2010
BOD True Total	02-Dec-2010	02-Dec-2010	02-Dec-2010
COD Unfiltered	27-Nov-2010	27-Nov-2010	27-Nov-2010
Colour Test	03-Dec-2010	03-Dec-2010	03-Dec-2010
Total Dissolved Solids (Grav)	01-Dec-2010	01-Dec-2010	01-Dec-2010
Total Metals by ICP-MS	29-Nov-2010	29-Nov-2010	29-Nov-2010
Total Suspended Solids	29-Nov-2010	29-Nov-2010	29-Nov-2010
TPH by IR Oils and Greases	07-Dec-2010	07-Dec-2010	07-Dec-2010

CERTIFICATE OF ANALYSIS

SDG:	101126-59	**Location:**	Milverton	**Order Number:**	
Job:	D_SLRCON_DUB-52	**Customer:**	SLR Consulting Ireland	**Report Number:**	106949
Client Reference:	501.0180.00018	**Attention:**	Peter Glanville	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

12. Results relate only to the items tested

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 14).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. Our MCERTS accreditation for PAHs by GCMS applies to all product types apart from Kerosene, where naphthalene only is not
accredited.

19. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

20. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

23. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute themajor part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

24. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
THIN LAYER CHROMATOGRAPHY	D&C	DCM	SOXTHERM	IATROSCAN
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE/ACETONE	END OVER END	GC-FID
PCB TOT / PCB CON	D&C	HEXANE/ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE/ACETONE	MICROWAVE TM218.	GC-MS
C8-C40 (C8-C40) EZ FLASH	WET	HEXANE/ACETONE	SHAKER	GC-EZ
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE/ACETONE	SHAKER	GC-EZ
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM/ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH-MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC-MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC-MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC-MS
PHENOLS-MS	DCM	SOLID PHASE EXTRACTION	GC-MS
TPH by INFRARED (IR)	TCE	LIQUID/LIQUID SHAKE	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID SHAKE	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC-MS

Identification of Asbestos in Bulk Materials

The results for asbestos identification for soil samples are obtained from possible Asbestos Containing Material, removed during the 'Screening of soils for Asbestos Containing Materials', which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in MDHS 100.

The identification of asbestos containing materials falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

River Name	(08_483)
XY Location	324877,259573 (ING)

River Segment Map

Disclaimer
The source hydrometric data used to estimate the flow duration curve ordinates for ungauged catchments was obtained from (1) water level data and (2) the rating curve(s) generated for each hydrometric station. The Environmental Protection Agency and the Office of Public Works used these data, respectively, to calculate daily mean flows. The daily mean flows were then used by the Environmental Protection Agency to prepare flow duration curves for each station. Neither body accepts any liability for the subsequent handling of the data.

Disclaimer

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The user should familiarise himself/herself with the catchment being studied and confirm that the ungauged site is in a natural catchment where flows conditions are suitable for the use of the model.

It is strongly recommended that the user examine the catchment descriptors contained in the report produced and confirm that the percentages of the various constituent elements are comparable to a natural catchment.

If the flow in a catchment is not entirely natural, the estimation of flows using the model in these catchments could be affected due to:

- existence of local conduit karst within the catchment;
- the selected location itself is on local conduit karst;
- regulation of the river flow on the river channel (e.g. power station, sluice gates etc)
- impacts of abstractions upstream of the selected location or the impact of the discharge associated with the abstraction into the same/different catchment;
- estimates of flow being sought at locations effected by storage effects at, or near, lake outfalls;
- lack of similar catchments with observed flows, ie where catchment descriptors lie outside the range of available gauging station catchments (e.g. the catchment area is under 5 km²);
- any other special circumstances that may affect river flows.

Expert judgement will be required to ensure that the estimate of flow is not unduly affected by any of these influences.

Please note that the model does not provide estimates of flood peaks and, specifically, should not be used for that purpose.

The EPA has also prepared estimates of DWF and long term 95 percentile flows which are also presented on the EPA web site. These data are presented at http://www.epa.ie/whatwedo/monitoring/water/hydrometrics/data/

The data produced by the model for specific stations should be compared to the data contained in this file of DWF and long term 95percentile flows.

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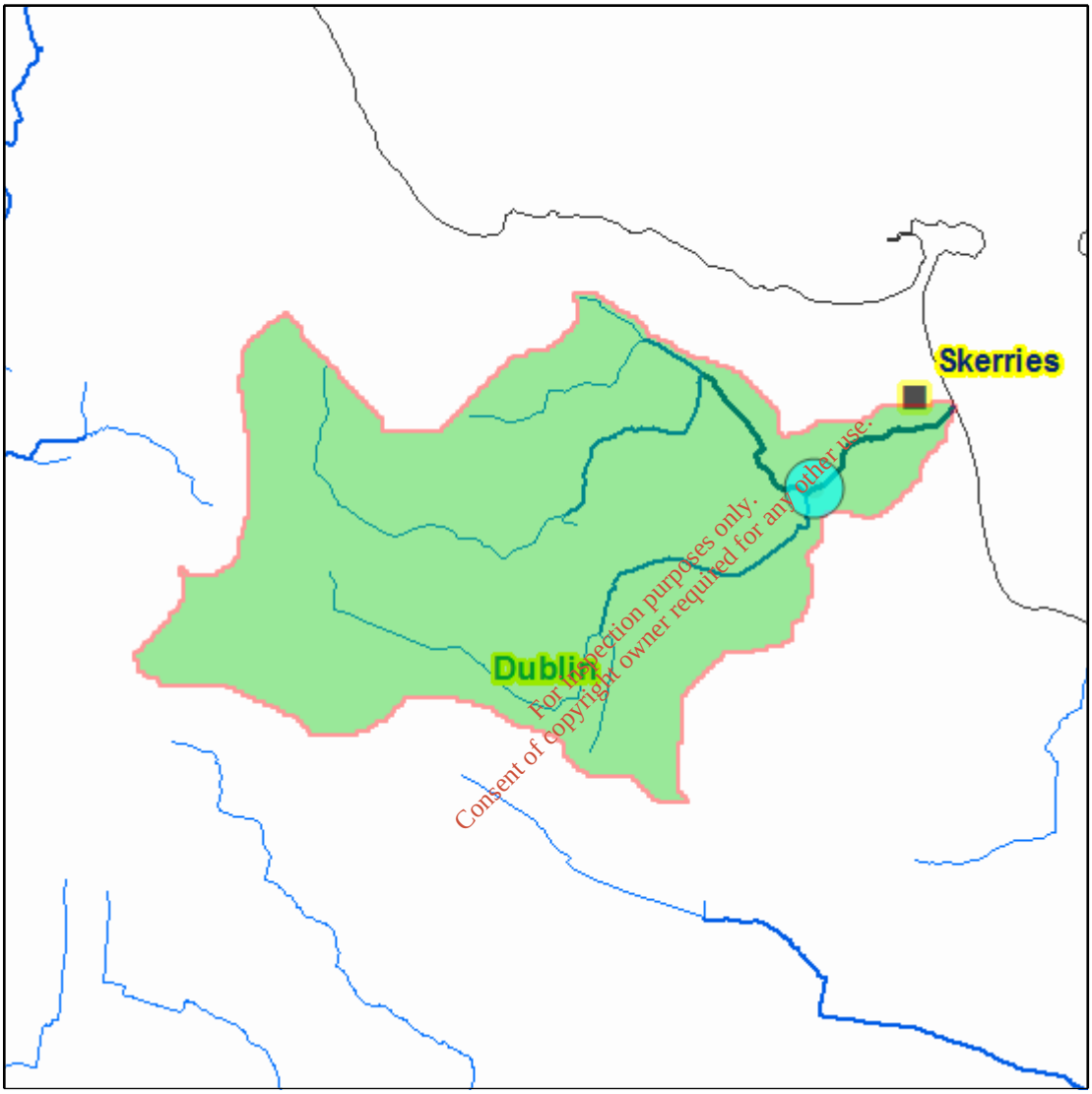
Estimation of Flow Duration Curve for Ungauged Catchment

Environmental Protection Agency

River Name	(08_483)
XY Location	324877,259573 (ING)

Nested Catchment Map



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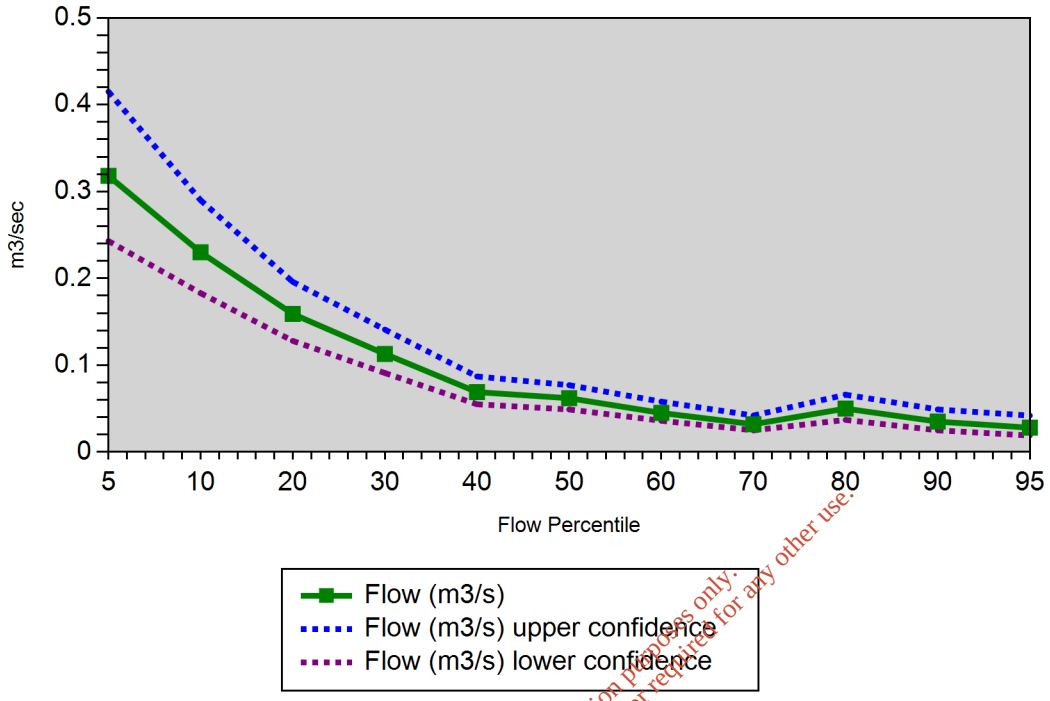
Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (Flow in m3/sec)



%ile	flow(m3/sec)	upper 95% confidence limit m3/sec	lower 95% confidence limit m3/sec
5	0.318	0.415	0.243
10	0.23	0.29	0.183
20	0.159	0.196	0.128
30	0.113	0.141	0.091
40	0.069	0.087	0.055
50	0.062	0.077	0.049
60	0.045	0.058	0.036
70	0.032	0.042	0.025
80	0.05	0.066	0.037
90	0.035	0.049	0.025
95	0.028	0.042	0.019

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Catchment Descriptors		
General		
Descriptor	**Unit**	**Value**
Area	sq km	8.2
Average Annual Rainfall (61-90)	mm/yr	700
Stream Length	km	13.9
Drainage Density	Channel length (km)/catchment area (sqkm)	1.7
Slope	Percent Slope	3.6
FARL	Index (range 0:1)	1

Soil	
Code	**% of Catchment**
Poorly Drained	22.9
Well Drained	67.2
Alluvmin	4.9
Peat	0
Water	0
Made	5

Disclaimer
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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Subsoil Permeability		
Code	**Explanation**	**% of Catchment**
H	High	9.3
M	Moderate	0
L	Low	69
ML	Moderate/Low	0
NA	No Subsoil/Bare Rock	21.6

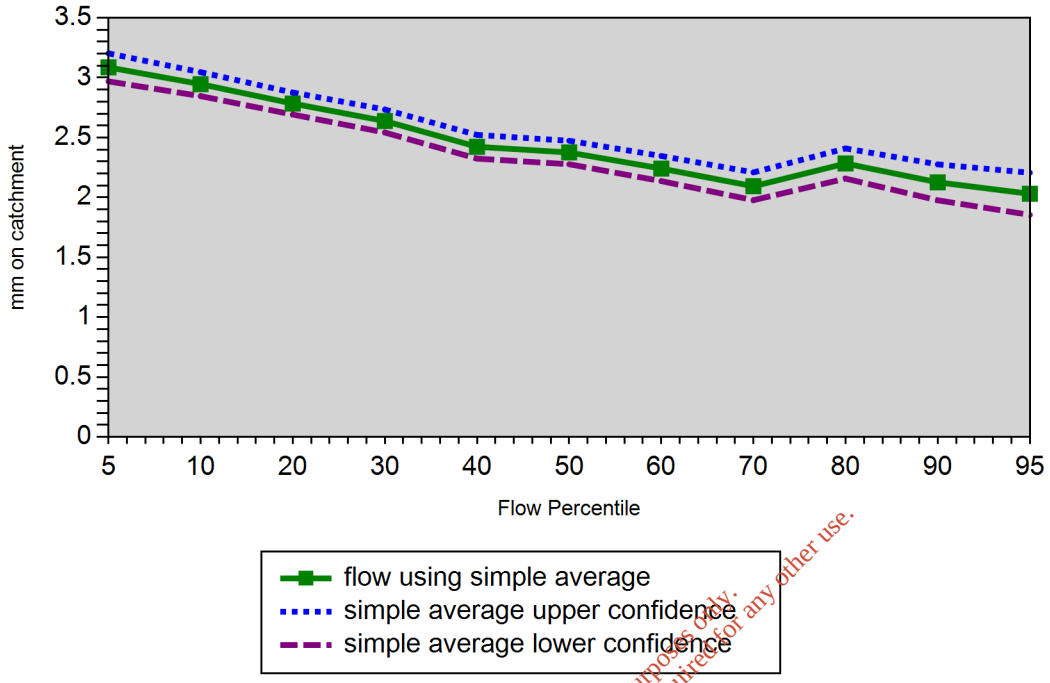
Aquifer		
Code	**Explanation**	**% of Catchment**
LG_RG	LG:Locally important sand-gravel aquifer RG: Regionally important sand-gravel aquifer	0
LL	Locally important aquifer which is moderately productive only in local zones	0.8
LM_RF	LM: Locally important aquifer which is generally moderately productive RF: Regionally important fissured bedrock aquifer	17.9
PU_PL	PU: Poor aquifer which is generally unproductive PL: Poor aquifer which is generally unproductive except for local zones	42.6
RKC_RK	Regionally important karstified aquifer dominated by conduit flow	0
RKD_LK	Regionally important karstified aquifer dominated by diffuse flow	38.7

Stations in Pooling group			
%ile Flow	**Station 1**	**Station 2**	**Station 3**
5	08011	10022	14014
10	08011	14014	10022
20	08011	14014	10022
30	08011	14014	10022
40	08011	09037	08012
50	10022	11001	08011
60	10022	11001	08011
70	10022	11001	08011
80	09027	13001	25001
90	09027	13001	25001
95	09027	13001	25001

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (mm on catchment)



Log Flow (mm on catchment)			
%ile	mm	upper 95% confidence limit	lower 95% confidence limit
5	3.086	3.203	2.969
10	2.946	3.046	2.846
20	2.784	2.876	2.692
30	2.638	2.734	2.542
40	2.423	2.522	2.324
50	2.375	2.473	2.277
60	2.241	2.346	2.136
70	2.093	2.209	1.977
80	2.283	2.409	2.157
90	2.126	2.276	1.976
95	2.03	2.206	1.854