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INTRODUCTION

6.1 This Environmental Impact Statement (EIS) provides supporting information to accompany a Planning Application to Fingal County Council by Roadstone Limited in respect of a proposed increase in the permitted waste intake to its existing licensed inert soil and stone recovery facility at the Huntstown Quarry Complex at North Road, Finglas, Dublin 11, from a maximum of 750,000 tonnes per annum at the present time to 1,500,000 tonnes per annum in future years.

6.2 This Chapter of the EIS presents baseline information on the local hydrology and hydrogeology of the application site and assesses the impact of the proposed increase in the rate of waste intake on the local hydrological and hydrogeological environment.

6.3 For the purposes of this assessment, the study area comprises the application site and surrounding area up to 5km radius around the application site boundary. Unmitigated potential impacts on hydrology and hydrogeology are considered for the initial assessment, before appropriate mitigation measures for the potential impacts identified are discussed, and the identified potential impacts reassessed assuming the identified mitigation measures in place.

6.4 The restoration of the entire quarry complex at Huntstown comprising backfilling of 4 separate quarry voids using imported soil and stone waste has previously been granted planning permission (Ref. FW12-0022 and An Bord Pleanála (ABP) Ref. 241693). An existing EPA waste licence (Ref. W0277-01) only applies in respect of ongoing backfilling and waste recovery activities at the North Quarry. Waste recovery activity at this facility has been ongoing since October 2015.

Background

6.5 There are currently three separate quarry voids at the Huntstown Quarry complex, at which limestone has been, or continues to be extracted. At one of these, the North Quarry, much of the available limestone has been extracted and there are physical constraints to any significant further development. Another, the South Quarry continues to be actively worked, while another, the Central Quarry will be extended and further developed in the short- to-medium term future.

6.6 The existing West Quarry was previously stripped of overburden soils to a depth of up to 3m in anticipation of its future development as a quarry. Having undertaken a detailed review of structural geology and extractable resources at the West Quarry in recent years however, Roadstone has decided not to proceed with further development of the planned West Quarry and to bring forward the backfilling and restoration of this area (which has been approved previously).

6.7 It is understood that in the short-to-medium term future, the proposed intensification of backfilling and waste recovery activities will be confined to the North Quarry and West Quarry at Huntstown. Further information on the site infrastructure, operations, environmental management systems and controls at the established facility is provided in the Chapter 2 of this EIS.

6.8 Groundwater from quarry dewatering and surface water run-off from existing ongoing activities at the North Quarry are passed through settlement ponds prior to discharge to the Ballystrahan Stream and Ward River catchment. Off-site discharge is currently regulated by way of the EPA waste licence (Ref.

W0277-01). Roadstone also discharges process water from aggregate and concrete production activities at the central infrastructure area via a series of existing settlement ponds to the Ballystrahan Stream. These discharges are regulated separately by way of a discharge licence from Fingal County Council (Ref. No WPW/F/008-01) issued on 24th November 2011.

Scope of Work

6.9 This Chapter describes the local hydrological and hydrogeological environment at and around the Huntstown quarry complex based on available information from the area. A qualitative assessment has been undertaken of the potential impacts on this environment arising from the proposed increased rate of backfilling of the North Quarry and West Quarry using imported inert soil and stone waste.

6.10 The assessment presented herein considers the waste types being handled, existing water management at the site and the potential impact of increased volume intake on the phasing of the backfilling works. The methodology of the assessment is described later in this Chapter.

Sources of Information

6.11 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 (1999), and Geology of Kildare-Wicklow (1994) 1:100,000 scale, Geological Survey of Ireland
- Groundwater Protection Schemes. Department of the Environment and Local Government, Environmental Protection Agency, and Geological Survey of Ireland, 1999; and
- Water Maps, Water Framework Directive online mapping (www.wfdireland.ie)

Contributors

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

- Peter Glanville, Principal Hydrologist, SLR Consulting Ireland

RECEIVING ENVIRONMENT

Available Information: Soil and Geology

6.13 A detailed description of the local and regional soil, subsoil and bedrock geology is provided in Chapter 5 of this EIS. A summary is provided below:

Soils and Subsoils

6.14 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 application site at Huntstown and the surrounding area is / was typically underlain by deep well drained mineral soils. These soils are derived from the underlying glacial till which extend across the North Dublin region. The glacial till is derived from limestone parent material (refer to Figures 5-1 and 5-2 in Chapter 5 of this EIS).

6.15 The soil at the application site has been removed previously to facilitate the extraction of rock at both quarries and there is currently little or no soil at either.

6.16 Inert soil and stone materials have been imported to the North Quarry since early October 2015. The imported materials comprise excess subsoils from excavations at construction and development sites in the Greater Dublin area and typically comprise local glacial tills ('Brown' or 'Black' Boulder Clay) .

6.17 The soils and subsoils from the Western Quarry have been removed previously to facilitate the possible extraction of rock. However, no extraction of rock took place here and it is now proposed to restore and backfill the void space.

Solid Geology

6.18 The soil and subsoil deposits at the site and surrounding area are underlain by bedrock of several lower Carboniferous Formations (refer to Figures 5-3 and 5-4 in Chapter 5 of this EIS). Regional geological maps indicate that four bedrock formations occur across the Huntstown Quarry complex. These are:

- The Boston Hill Formation: described as a rather uniform, thick successions of nodular diffusely bedded, argillaceous fossiliferous limestones (and their dolomitised equivalents) and subordinate thin shales. Improved understanding of local structural geology means that this formation is now recognised as part of the Malahide Formation.
- The Waulsortian Limestone is described as mainly pale grey biomicrite.
- The Tober Colleen formation described as very gradationally-interbedded calcareous mudstone and very argillaceous micrite. It overlies, and fills in the gaps between depressions of the Waulsortian Limestones.
- The Malahide Formation: at its top, is described as a fossiliferous limestone and shale with some oolites and sandstone, biomicrites and biosparites.

Local Geology

6.19 The bedrock geology of the Huntstown area is complex. It has however been extensively studied and is the subject of published research, summarised in Section 5 of this EIS. The predominant bedrock at Huntstown is limestone, grouped into the Waulsortian, Malahide (Boston Hill) and Tober Colleen Formations, as previously described.

6.20 Six groundwater monitoring wells (designated GW01 to GW06) were installed across the Huntstown Quarry complex in July 2010. The locations of these monitoring wells are shown on Figure 6-1 and Figure 6-5. The well construction records are presented in Appendix 6-A.

6.21 The monitoring wells were constructed using rotary percussion drilling techniques, and therefore only general descriptions were obtained of bedrock encountered. Where not affected by quarrying activities, the depth to bedrock across the quarry complex ranges from 1.9m to 13m. The boreholes were drilled to a final depth of between 49m and 80.5m below ground level. Groundwater monitoring piezometers were installed so that specific response zones could be isolated from other water ingress.

Available Information: Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

6.22 The overall quarry complex at Huntstown is located across the Swords Groundwater Body (GWB) and the Dublin GWB, the boundary between which is inferred to run through the middle of the site, refer to Figure 6-6. The southern part of the quarry complex is located in the Dublin GWB. The northern part of the quarry complex is located in the Swords GWB. The application site is predominantly located over the Swords GWB, however a small section of the manufacturing area and the southern area of the West Quarry is indicated to occur over the Dublin GWB, see Figure 6-6.

6.23 There are no identified groundwater supply source protection areas within the Swords GWB (www.gsi.ie). There are no major abstractions for groundwater supply from the Dublin GWB. The source protection area for a wellfield at Dunboyne extends marginally into the Dublin GWB. The source protection zone for this wellfield however is 8.5 km west of the Huntstown Quarry complex. Huntstown Quarry itself represents probably the largest groundwater abstraction from the Swords or Dublin Groundwater Bodies.

6.24 The predominant bedrock at Huntstown is limestone. As is typical of Irish bedrock, groundwater flow through the limestone formations is controlled by secondary fissure permeability. The bulk permeability of the limestone formations are relatively high, with groundwater storage and movement mainly constrained to the upper weathered horizons of each unit and to discontinuities (such as such as joints, fractures and faults).

6.25 Bedrock aquifer maps published on the GSI website indicate that the Huntstown Quarry complex straddles bedrock formations which are generally considered to be Locally Important (LI), karstified aquifers. Of the three bedrock formations exposed at Huntstown, both the Waulsortian and Malahide (Boston Hill) Formations are considered to be Locally Important Aquifers (LI), while the Tober Colleen Formation is considered to be a Poor Aquifer (Pl). An extract of the bedrock aquifer map is presented as Figure 6-2.

6.26 The subsoil deposits that overlie the bedrock at Huntstown tend to be relatively thin but play an important role in groundwater recharge. Where there are glacial till subsoils present there will be reduced groundwater recharge to the underlying bedrock due to the lower permeability of the tills. Where glacial till subsoils are absent at the site then recharge will be directly to the underlying bedrock.

6.27 Groundwater vulnerability maps published on the GSI website indicate that the Huntstown Quarry complex is located within an area with high to extreme groundwater vulnerability status. This is principally due to the fact that subsoil has been removed over virtually the entire site. An extract of the groundwater vulnerability map is presented as Figure 6-3. The groundwater vulnerability reflects the exposed nature of the quarry area, owing to the removal of subsoils.

6.28 The quarry excavations at Huntstown have intersected the groundwater table and lowered it around the periphery with the excavation of each quarry bench. There are minor groundwater inflows to each of the quarries that drain to the quarry 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 pumps are active, the North Quarry has an estimated discharge rate of around 20l/sec.

6.29 Surface water run-off (and dewatered groundwater) is currently managed on the floor of the North Quarry, outside of the area which is currently being actively backfilled. Water on the floor collects in a sump at a low point and is pumped up to the eastern edge of the quarry void where it falls under gravity to the licensed discharge point. The pump on the quarry floor is floating on the sump and is automated via an automatic float level switch.

6.30 Water in the West quarry infiltrates naturally to the ground and in general, there is no requirement for surface water management in this quarry. On occasion, some surface water is pumped across to ponds at the North Quarry for use in production processes and/or dust suppression.

6.31 A review of the GSI karst database (www.gsi.ie) indicates that there are no karst landforms or features within 5 km of the Huntstown Quarry complex.

Rainfall and Climate

6.32 The Average Annual Rainfall (AAR) in the area around Huntstown is c. 824 mm/yr. for the period 1981-2010 (Met Eireann, 2012). The monthly average rainfall values for 1981-2010 are shown in below in Table 6-1.

Table 6-1
Monthly Rainfall Averages (mm) 1981-2010 for Huntstown

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AAR
70	53	57	58	65	72	59	80	65	86	79	80	824

6.33 Rainfall values for one-hour and two-day storm events of 5-year return period intensity are 16mm and 59.6mm respectively, see Met Eireann Depth Duration Frequency rainfall return table in Appendix 6-B.

Groundwater Recharge

6.34 The groundwater recharge potential has been modelled by the Geological Survey of Ireland (GSI) based on subsoil characteristics, aquifer type, soil drainage and bedrock geology.

6.35 The groundwater recharge beneath the existing quarries at the application site has been assessed by the GSI in accordance with the guidelines from the Irish Working Group on Groundwater (WGGW, 2005). The effective rainfall at the application site is assessed as 419 mm/yr. and the maximum groundwater recharge capacity is 200 mm/yr (www.gsi.ie).

6.36 The Water Framework Directive's Working Group on Groundwater (2005) however has suggested that a reasonable 'cap' on recharge to locally important aquifers would be 150mm/year to 200 mm/year and that any incident rainfall in excess of this will be rejected as run-off. The bulk of this groundwater recharge would be likely to occur between late October and early March.

Groundwater Levels and Flow

6.37 The published geological memoir reports that across the eastern region of Ireland, groundwater is generally within 10m of the surface and has an annual fluctuation of less than 5m.

6.38 During the groundwater well installation works in July 2010, groundwater strikes were recorded at all wells during drilling. A summary of water strikes is presented in Table 6-2 below with elevations.

Table 6-2
Groundwater Strikes Recorded during Well Drilling (July/August 2010)

Borehole Name	Well depth (m)	Water Strike (mbgl)	Water Strike (mOD)	Water Level (mbgl) 05/08/10	Water Level (mOD) 05/08/10
GW01	61	54	26.98	25.47	56.27
GW02	55	32	49.51	11.99	70.34
GW03	49	31	46.94	20.46	58.01
GW04	61	54	26.88	29.59	52.14
GW05	55	14.5	70.01	10.81	74.52
GW06	80.5	49	33.16	40.46	42.32

6.39 Water levels presented here were recorded on the 5 August 2010, approximately three weeks after the completion of drilling and groundwater monitoring well installation. Groundwater level monitoring is ongoing at the site by Roadstone.

6.40 Recent groundwater levels at GW01 to GW05 are shown in Table 6-3 and summary groundwater levels are shown in Table 6-4 below.

Table 6-3
Groundwater Levels

Date	GW01 (mOD)	GW02 (mOD)	GW03 (mOD)	GW04 (mOD)	GW05 (mOD)
Ground Level mOD	*80.98*	*81.51*	*77.94*	*81.21*	*84.95*
21/05/2015	<51.74	75.61	59.57	60.03	83.14
24/06/2015	<51.74	59.53	60.25	55.75	78.78
20/07/2015	<51.74	62.83	59.12	53.99	77.31
26/08/2015	<51.74	58.03	57.87	52.43	78.64
29/09/2016	<51.74	65.53	57.62	53.33	78.13
18/11/2015	<50.98	68.23	58.09	60.53	82.32
13/01/2016	54.04	79.12	66.76	62.43	83.93
31/03/2016	<50.98	67.43	61.57	57.63	83.35
16/06/2016	45.28	58.65	58.53	53.73	77.09

Table 6-4
Summary Groundwater Levels (May 2015 to June 2016)

	GW01 (mOD)	GW02 (mOD)	GW03 (mOD)	GW04 (mOD)	GW05 (mOD)
Maximum	54.04	79.12	66.76	62.43	83.93
Average	-	66.11	59.93	56.65	80.30
Minimum	-	58.03	57.62	52.43	77.09

Table 6-5
Variation in Groundwater Levels (May 2015 to June 2016)

	GW01 (m)	GW02 (m)	GW03 (m)	GW04 (m)	GW05 (m)
Variation		21.09	9.14	10.00	6.84

6.41 Groundwater level details for the Huntstown site are shown in Table 6-3, Table 6-4 and Table 6-5 above. Note that monitoring well GW06 has dried out on account of recent deepening of the South Quarry and as a result there are no recent records of water levels at this location.

6.42 Groundwater levels around the quarry complex are influenced by their proximity to dewatered quarry voids which lowers groundwater level in the immediate vicinity, refer to Figure 6-1. As indicated by Table 6-3, groundwater levels vary from within c.8m of the ground surface at GW05 at the West Quarry up to c.36m at GW01, to the east of the South Quarry, Groundwater levels are most likely controlled by both distance from quarry voids and variations in bedrock geology.

6.43 Groundwater contours based on winter recorded groundwater levels in the monitoring wells, measured on the 13/01/2016, have been used to determine groundwater contours in the area, presented on Figure 6-1. The groundwater levels in January 2016 followed a particularly wet Autumn period and reflect maximum winter groundwater levels over the period May 2015 to June 2016.

6.44 These data establish the indicative groundwater flow directions across the Huntstown Quarry Complex. They indicate that on 13 January 2016, the floor of the North Quarry at 37mOD, was c.25m below the groundwater table at GW04 (140m away) while that at the deepest quarry floor, at the South Quarry, at 20mOD, is 30m below the groundwater table at GW01 (c.1km away).

6.45 The depths to groundwater indicate that the existing dewatering operations at Huntstown have lowered groundwater levels over a significant area around the quarry complex and have locally altered the regional groundwater flow regime in the surrounding aquifer, diverting it toward sumps on quarry floor(s). Based on the distance-drawdown method, it is estimated that a reduction of 10m in groundwater levels extends from the quarry faces to 1.1 km from the quarry complex.

Groundwater Abstractions: Use and Quality

6.46 The GSI national well database records indicate that there are 12 wells or drill holes within 1 km of the Huntstown Quarry complex. Of these, only 2 appear to be wells used for groundwater abstraction: one is in the Waulsortian Limestone Formation to the west of the site, and one, also in Waulsortian Formation is to the south of the site.

6.47 Much of the potable water demand in Huntstown and the surrounding area is satisfied by a Local Authority mains supply. The adjoining Huntstown Power Station sources approximately 150m^3/day of water from an on-site well for operational use.

6.48 Under Ireland's obligations for the Water Framework Directive, the status of groundwater bodies nationally has been assessed (www.wfdireland.ie), both on the basis of their quality and availability. The Swords GWB is classified as being of 'Good' overall status and is identified as being '*probably not at risk*' of losing its current 'Good' status. The Dublin GWB is also classified as being of

Good overall status, however it is classified as being '*at risk*' of losing its current 'Good' status from urban development pressures.

6.49 At the quarry itself, water abstraction for the concrete, aggregate washing and processing is sourced from sumps on the southern quarry floor which collect groundwater ingress and run-off water. These sumps are continually pumped to maintain dry conditions on the quarry floor.

6.50 Groundwater samples were obtained from the monitoring wells in August 2010 and more recently in 2015 and 2016. Water quality test parameters from August 2010 are presented in Table 6-6 below. Summary groundwater quality data for three rounds of sampling undertaken between 2015 and 2016 is presented in Table 6-7.

Table 6-6
Groundwater Quality (August 2010)

	GW01	GW02	GW03	GW04	GW05	GW06	IGV*
pH	7.34	6.84	7.46	7.32	6.86	7.12	6.5 -9.5
Conductivity	114	229	376	512	681	354	1000
Sodium	24.52	17.89	28.62	25.42	16.89	18.45	150
Potassium	3.54	2.99	4.01	3.12	1.58	2.57	5
Calcium	80.7	75.45	92.52	85.42	68.57	78.45	200
Magnesium	17.54	15.42	20.27	19.85	14.56	20.12	50
Chloride	19.23	24.68	43.11	27.49	19.51	34.16	30
Sulphate	48.96	12.09	17.24	36.11	24.66	18.71	200
Total Alkalinity	301	292	351	332	247	313	NAC
Total Hardness	340	352	440	494	220	252	200
Nitrate	18.66	12.45	24.77	16.62	9.32	6.44	25
Nitrite	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1
Ammoniacal Nitrogen	0.02	0.01	0.04	0.02	0.01	<0.01	0.15
Iron	0.006	<0.001	0.052	<0.001	<0.001	0.067	0.2
Manganese	0.001	<0.001	0.013	<0.001	<0.001	0.021	0.05
Orthophosphate	0.1	0.09	0.06	0.02	<0.01	0.01	0.08
Total Organic Carbon	4.1	4.4	1.5	0.5	3.2	9.9	NAC

Shaded — Maximum admissible concentration exceeded

IGV — Interim Guideline Value for groundwater, as set out in the EPA Publication 'Towards setting Guideline values for the Protection of Groundwater in Ireland'.

6.51 The groundwater quality data from August 2010 indicate that the groundwater at Huntstown can be considered to be of good status. Virtually all parameters analysed had ion concentrations lower than the Interim Guideline Values (IGV) set out in the EPA Publication '*Towards setting Guideline values for the Protection of Groundwater in Ireland*'. The guideline value for chloride was exceeded at two locations, but this may be due to proximity to the coast (12-km), and its seawater. All samples exceeded the guideline for hardness, but it should be noted that hardness occurs naturally at high concentrations in limestone bedrock. About 65% of all groundwater samples from the recent national database have hardness in excess of 200 mg/l. Values of orthophosphate exceeding the guideline value may be the result of local fertiliser application.

Table 6-7
Summary GW Quality data (2015-2016 for three samples)

Parameter	Unit	Limit	GW01			GW02			GW03			GW04			GW05		
			Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.
Ammoniacial Nitrogen	mg/l		<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.34	0	0.23	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Conductivity	uS/cm @ 20°C		1043	883	728	1316	938	651	933	844	704	844	822	778	516	498	481
Diesel Range Organics	mg/l		0.059	0.043	0.026	0.025	0.015	0.010	0.023	0.014	0.010	0.028	0.016	0.010	0.032	0.022	0.010
Nitrate	mg/l		1	0.7	0.5	1	0.8	0.5	1	0.7	0.5	4	3.3	3	<0.5	<0.5	<0.5
Nitrite	mg/l		<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20
Orthophosphate as P	mg/l		<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33
pH	pH Units		7.3	7.2	7.1	7.3	7.2	7.1	7.4	7.3	7.1	7.4	7.2	7	7.6	7.6	7.6
PRO	mg/l		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
TPH	mg/l		0.067	0.039	0.01	0.052	0.024	0.01	0.045	0.022	0.01	0.067	0.029	0.01	0.068	0.034	0.01
Faecal Coliforms	cfu/100ml		6	3	0	25	9	0	0	0	0	0	0	0	4	1	0
Total Coliforms	cfu/100ml		15	10	8	>100	72	16	4	3	3	8	3	0	6	3	2

6.52 The hydrochemistry of the groundwater samples from 2015-2016 (on 3 No. samples from each location, see Table 6-7) indicates generally good groundwater quality across the five wells and in the aquifer around and beyond the Huntstown quarry complex. Nitrate and nitrite is low and conductivity is below the threshold value of 1875µs/cm. Some coliforms have been recorded in samples, although faecal coliforms are low or absent from the monitoring wells. Hydrocarbons including Diesel Range Organics (DRO) and Total Petroleum Hydrocarbons (TPH) are recorded in samples but are present at relatively low levels only. Petrol Range Organics (PRO) are below laboratory detection level.

Groundwater Protection

6.53 The term 'groundwater protection' refers to the ability of subsoils to reduce an influent contaminant load through a variety of biological, physical and chemical processes. The thickness of unsaturated subsoil above an aquifer is therefore a key parameter in determining how well-protected it is. However, the importance of the resource to be protected (i.e. the size of the aquifer) is also fundamental to the magnitude of the risk.

6.54 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 (i.e. receiving a 'traditional' waste stream of municipal solid wastes, and commercial and industrial wastes). It is therefore not a directly applicable tool for assessment of inert soil recovery facilities such as the existing licenced recovery facility at Huntstown.

6.55 Notwithstanding this, the Groundwater Vulnerability Map (Figure 6-3) and the Aquifer Map (Figure 6-2) indicate that the application site at Huntstown is located within an area of extreme 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 R2[2], which is described as being 'acceptable subject to guidance outlined in the EPA Landfill Design Manual or conditions of a waste licence'. The existing facility at the application site has been operating since October 2015 in accordance with existing waste licence conditions (Licence Ref. W0277-01).

6.56 The backfilling of the existing quarry using predominantly cohesive inert glacial till provides, and will continue to provide, an enhanced degree of groundwater protection, as the backfill soils generally have a low permeability and will be of significant thickness (>3m) upon completion of the backfilling and restoration activity.

Available Information: Hydrology

Local Hydrology: Surface Water Bodies

6.57 The Huntstown quarry complex straddles two river catchments, that of the Ward River to the north and the Tolka River to the south, with approximately equal areas of the landholding in each catchment, as shown in Figure 6-4.

6.58 The existing licensed inert soil recovery facility is located in the North Quarry, which lies in the northern part of the landholding, and is entirely within the Ward River catchment. However, a small part of the southern boundary of the West

Quarry is indicated to lie within the Tolka catchment, see Figure 6-4. Due to the relatively flat nature of the ground in this area at the present time, it is difficult to precisely identify the catchment boundary at the site.

6.59 In reality land drainage works and surface water managements systems at Huntstown will have slightly altered the boundary between the Ward and Tolka catchments across the application site and the wider area. Of relevance in this case is that excess surface water from the West Quarry is occasionally pumped north across an internal haul road to sumps at the North Quarry, which has the effect of placing the entire West Quarry within the Ward River catchment.

6.60 Surface water bodies at the application site are man-made and comprise sumps on the quarry floors, settlement ponds and channels for water management, and semi-permanent ponds.

6.61 The soils and subsoils in the West Quarry have been stripped off and shallow semi-permanent ephemeral ponds have developed in slight topographic lows or closed depressions above the bedrock (which are most likely to be self-sealed with fine silt and/or sediment). Water from the ponds percolates naturally to the rock beneath them or evaporates and is occasionally removed by pumping. The area of the ponds changes depending on rainfall and evaporation rates and some ponds can dry out completely.

Local Hydrology: Quality

6.62 The Ward River and its tributary the Ballystrahan stream are classified as being of 'Poor' status (www.epa.ie). The River Ward itself has a median Q-rating of 3 (unsatisfactory). Siltation by agriculture and urban wastewater discharges are believed to be the principal contributors to reduced water quality in the catchment.

Local Hydrology: Flows

6.63 The EPA hydrometric website indicates that there was previously a hydrometric station on the River Ward at Owens Bridge, approximately 4.5 km north-east of the Huntstown Quarry complex. This station is however no longer in operation. When operational, it had recorded flow from a catchment area of approximately 36 km^2, but this does not include the Ballystrahan sub-catchment (in which the application site is situated).

6.64 As part of work for the Water Framework Directive, the EPA has prepared an internet-based model for the calculation of ungauged catchments (http://watermaps.wfdireland.ie/HydroTool/), and, for a 7 km^2 area of the Ballystrahan catchment at St. Margaret's, the flows in Table 6-8 have been estimated. Note that the error associated with this model can be in the region of 50%, but it is an improvement on other desk-based methods.

Table 6-8
Flows Estimated for the Ballystrahan Sub-Catchment at St. Margarets

Flows equalled or exceeded for the given percentage of time (litres/sec)										
5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
317	209	131	92	71	66	50	36	25	15	11

Discharge Consents

6.65 There are currently four monitored discharge points at and adjacent to the Huntstown Quarry complex:

- A discharge to the south (from the southern quarry and surrounding areas), into the River Tolka catchment (Discharge Licence WPW/F/075), designated W3. This discharge is not within the catchment for the existing inert waste recovery facility operation, and so will not be discussed further.
- A discharge from the central quarry, northwards to the Ward catchment, designated W2. Downstream of the monitoring point, this discharge mixes with that from the aggregate processing area / concrete production plant and that from the North Quarry.
- A discharge from the settlement pond which receives influent groundwater and rainwater from the North Quarry, designated W4. This discharge is the one of most direct relevance to the ongoing soil and stone waste recovery activities and the application under review.
- A combined discharge further downstream from W4 which receives waters from the North Quarry and wastewaters from aggregate processing / concrete production area. This combined discharge ultimately discharges to the Ward River catchment at a discharge point designated W1. This discharge is also of relevance to the application under review.
- A discharge from Huntstown Power Station, which discharges to the Ballystrahan Stream.

Locations of surface water monitoring points are identified on Figure 6-5.

6.66 Discharges from the ongoing waste recovery activities at the North Quarry are monitored separately and controlled by way of the EPA Waste Licence (Ref. W0277-01) at the monitoring / control point at W4. It is anticipated that this dedicated discharge control point will remain in place should approval for increased waste intake the recovery facility be granted.

6.67 A revised effluent discharge licence in respect of combine waters from the North Quarry and concrete production facility (Ref. WPW/F008-01) was issued by Fingal County Council in November 2011, see Appendix 6-C. This discharge licence imposes water quality and volume (1,800m^3 over any 24hr. period) limits on the combined discharges of water from the North Quarry and aggregate processing / concrete production areas. The discharge licence also requires that the discharged water, and samples upstream and downstream of the discharge point, are tested on a monthly basis for water quality. Sample locations are indicated on Figure 6-5 (W1 and DL).

Surface Water Quality

6.68 Surface water quality has been monitored in compliance waste licence and discharge licence for the North Quarry. The water quality is monitored at four locations for compliance monitoring and details of the monitoring programme from the start of the Waste Licence are summarised in Table 6-9.

Table 6-9
Surface Water Compliance Monitoring (October 2015 to April 2016)

Name	Location	Purpose of Monitoring	Number of Samples
N.v-notch (W1)	Weir for discharge to Ballystrahan Stream	Discharge licence	14
Upstream (DL)	Upstream of discharge point	Discharge licence	4
Downstream (DL)	Downstream of discharge point	Discharge licence	4
W4	Pumped water from N. Quarry after the settlement lagoon	Waste Licence	2

6.69 Results of recent water quality monitoring for the Discharge Licence and Waste Licence at each of the monitoring locations are set out in Table 6-10, Table 6-11 and Table 6-12. More detailed water quality test results are presented in Appendix 6-D.

Table 6-10
Water Quality Results for Discharge to Ballystrahan Stream (W1)

Parameter	Unit	Discharge Licence Limit (W1)	Waste Licence Emission Limit (W4)	Number of Samples	Discharge to Ballystrahan Stream (W1)- (N. v-notch weir)		
					Min.	Avg.	Max.
Parameter	Units	MAC Value	MAC Value	No. Samples	Minimum	Average	Maximum
pH	pH Units	6.0-9.0	6.0-9.0	19	7.7	7.9	8.1
Temperature ^{o}C	^{o}C	25	25	19	5	11	18
BOD	mg/l	5	5	19	<2	<2	<2
Suspended Solids	mg/l	20	15	19	1	15	39
Ammoniacial Nitrogen	mg/l	-	-	18	0.08	0.14	0.26
Orthophosphate as P	mg/l	-	0.5	16	<0.33	<0.33	<0.33
COD	mg/l	30		8	4	7	10
Detergents as MBAS	mg/l	10	-	8	<0.05	0.09	0.28
Dissolved Oxygen	mg/l		-	8	8.3	9.15	9.9
Mineral Oil	mg/l	10	-	8	0.01	0.016	0.023
Phosphate as P	mg/l	1	-	6	0.33	0.50	1
Sulphate	mg/l	300	-	8	221	241	280
Ammonia as NH4	mg/l	1	0.5	7	<0.1	<0.1	<0.1
Zinc	mg/l	-	-	3	0.01	0.01	0.01
Cadmium	mg/l	-	-	3	<0.03	<0.03	<0.03
Copper	mg/l	-	-	3	<0.05	<0.05	<0.05
Iron	mg/l	-	-	3	<0.05	<0.05	<0.05
Lead	mg/l	-	-	3	0.2	0.24	0.26
Magnesium	mg/l	-	-	3	17	19	22

Parameter	Unit	Discharge Licence Limit (W1)	Waste Licence Emission Limit (W4)	Number of Samples	Discharge to Ballystrahan Stream (W1)- (N. v-notch weir)		
					Min.	Avg.	Max.
Manganese	mg/l	-	-	3	<0.03	<0.03	<0.03
Nickel	mg/l	-	-	3	<0.01	<0.01	<0.01
Dissolved Solids	mg/l	-	-	3	415	448	468
DRO	mg/l	-	-	2	0.021	0.023	0.025
TPH	mg/l	-	-	2	0.03	0.039	0.048

Table 6-11
Water Quality Results Upstream of Discharge to Ballystrahan Stream

Parameter	Unit	Upstream of Discharge to Ballystrahan Stream			
		18/11/2015	13/01/2016	26/02/2016	31/03/2016
pH	pH Units	8.1	7.7	7.6	7.9
Temperature	^{o}C	11	9	10	12
BOD	mg/l	3	<2	<2	<2
Suspended Solids	mg/l	79	2	<1	12
Ammonia as NH4	mg/l	<0.10	<0.10	0.62	0.23
Mineral Oil	mg/l	0.03	<0.010	<0.010	<0.010

Table 6-12
Water Quality Results Downstream of Discharge to Ballystrahan Stream

Parameter	Unit	Downstream of Discharge to Ballystrahan Stream			
		18/11/2015	13/01/2016	26/02/2016	31/03/2016
pH	pH Units	8.1	7.9	7.9	7.9
Temperature oC	^{o}C	11	6	8	10
BOD	mg/l	<2	<2	<2	<2
Suspended Solids	mg/l	11	9	13	7
Ammonia as NH4	mg/l	<0.10	<0.10	<0.10	<0.10
Mineral Oil	mg/l	0.011	<0.010	<0.010	<0.010

Table 6-13
Water Quality Results for Waste Licence Emission Monitoring Point W4

Parameter	Unit	ELV	W4 - Pumped Water from North Quarry				
			05/05/2016	12/05/2016	16/05/2016	26/05/2016	09/06/2016
pH	pH Units	6.0-9.0	7.6	7.7	7.9	8	7.9
Temperature oC	^{o}C	25	13	14	12	13	17
BOD	mg/l	5	<2	<2	<2	<2	<2
Suspended Solids	mg/l	15	16	4	3	2	5
Ammoniacal Nitrogen	mg/l	0.5	<0.1	<0.08	<0.08	<0.08	<0.08
Orthophosphate as P	mg/l	0.5	<0.33	<0.33	<0.33	<0.33	<0.33

6.69 The off-site discharge at monitoring / control point W1 (v-notch weir) is generally of good quality except for suspended solids. The level of suspended solids at the weir exceeded the Discharge Licence Limit of 20mg/l on four occasions (see Appendix 6-D). As previously noted, the off-site discharge at W1 includes run-off from other areas of the quarry complex other than just the North Quarry which also generate suspended solids.

6.70 The recorded water quality upstream and downstream of the discharge point at the v-notch weir (W1) presented in Table 6-11 and Table 6-12 respectively indicates that the receiving waters are generally of reasonable quality, with low suspended solids downstream of the discharge point. The sample upstream of the discharge point taken on 18/11/2015 indicates high suspended solids which is not present in the sample downstream of the same date. There are also some hydrocarbons recorded in the sample on the same date which are present upstream and downstream of the discharge point.

6.71 Waste Licence Emission monitoring point W4 is for water discharges solely from the location of ongoing recovery activities at the North Quarry. Five sets of recent monitoring results for this monitoring point are shown in Table 6-13 above. The water quality is within the Emission Limit Values (ELV's) set by the existing EPA Waste Licence except for a minor exceedence (by 1mg/l) of the limit for suspended solids recorded for a sample taken on 05/05/2016. It should however be noted that subsequent, more recent test results were generally less than half of the permitted limit value.

Discharge Volumes

6.72 The discharge from the North Quarry is limited to a maximum of 1,800m^3 over any 24 hour period by Condition No. 11 of the discharge licence (refer to Appendix 6-C). The discharge volume is monitored on a continuous basis at the v-notch weir and the summary daily maximum and average volumes discharged are shown In Table 6-14 by month.

Table 6-14
Summary Discharge Volumes to Ballystrahan Stream (2015 - 2016)

Month	Maximum Daily (m^3/day)	Average Daily (m^3/day)
March 2015	1,751	958
April 2015	1,973	602
May 2015	1,968	813
June 2015	1,125	469
July 1st to 17th 2015	1,090	502
August 7th to 31st 2015	1,556	511
September 2015	1,953	376
October 2015	1,845	286
November 2015	1,750	871
December 2015	1,885	1,635
January 2016	1,874	1,325
February 2016	2,036	1,384
March 2016	1,630	938

Month	Maximum Daily (m^3/day)	Average Daily (m^3/day)
April 2016	1,905	996
May 2016	1,097	538
June 2016	1,256	354

6.73 The daily discharge volumes from the 18th July to the 7th August are not available as there was a fault with the discharge flow logger and no discharge flow measurements were recorded. The logger fault was repaired in early August 2015 and recording resumed on the 7th August.

6.74 The daily discharge volumes recorded at the weir indicate that the maximum discharge is close to the discharge licence limit of 1,800 m^3/day, and was exceeded on a number of occasions, see Table 6-14. The permitted daily discharge volume was exceeded 21 times between March 2015 and June 2016.

Flooding

6.75 The Office of Public Works (OPW) website (www.floodmaps.ie) indicates that there is a record of one historic flood event in the vicinity of Huntstown, at Kilshane Cross in November 2002. This flood was attributed to 'runoff from adjacent grasslands', and was not related to quarrying activities at Huntstown.

6.76 Surface water run-off and discharges at the Huntstown Quarry complex are managed on a continual basis so that they do not increase the risk of flooding in the surrounding area. The North Quarry discharge has a discharge licence with a daily limit on the volume. An assessment was previously undertaken for the channel carrying capacity of the Ballystrahan stream in connection with the discharge licence application, in order to demonstrate the existing channel capacity for the discharge.

6.77 The OPW has produced a model flood extent map for the Ward River (www.opw.ie) which extends up the lower reaches of the Ballystrahan Stream, but not to the site which is located at the headwaters of the stream. The flood mapping indicates some flooding along the channel for the modelled 1% Annual Exceedance Probability event within c. 0.5km of the confluence with the Ward River.

Field Surveys

6.78 Site visits and inspections of the North Quarry and application site were undertaken by an SLR hydrogeologist during 2010 at the time groundwater wells were installed and by a SLR hydrologist in 2010, during the preparation of the EIS for the Waste Licence in 2011 and in June 2016. SLR hydrologists also visited the site on a number of occasions in 2011 and 2012 in connection with the preparation of discharge licence applications.

6.79 The key objective of the site visits was to assess the existing hydrological and hydrogeological environment and establish existing surface water management activities at and in the vicinity of the overall Huntstown quarry complex.

Limitations

6.80 The assessment of the hydrological and hydrogeological environment presented above is based on visual observations from site visits, available monitoring records, published information and discussions with personnel employed on site. It should be viewed as a largely qualitative assessment.

IMPACT OF PROPOSED DEVELOPMENT

Evaluation Methodology

6.81 The impacts of the proposed increase in material to the existing inert waste recovery facility on the local surface water and groundwater environment are assessed in this section.

6.82 The methodology applied here 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.

6.83 The assessment of risk is based on the matrix outlined in Table 6-15 below.

Table 6-15
Matrix Used to Assess Potential Impacts

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

6.84 The assessment of likely magnitude of potential impacts in relation to hydrogeology and hydrology is assessed in accordance with criteria detailed in Table 6-16 below.

Table 6-16
Magnitude of Potential Hydrological and Hydrogeological Impacts

Magnitude	Potential Impact
Negligible	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	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 of surface runoff and groundwater. .
Moderate	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.

Magnitude	Potential Impact
Severe	Wholesale changes to watercourse channel, route, hydrology or hydrodynamics; Changes to site resulting in an increase in runoff with flood potential Significant changes to erosion and sedimentation patterns; and Major changes to the water chemistry or hydro-ecology.

6.85 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 impacts will be cumulative.

6.86 The following sections identify the potential impacts of the proposed increase in material to the existing development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with Table 6-15 and Table 6-16. It should be noted that the impacts are initially assessed with no mitigation or design measures incorporated to reduce the risk.

Potential Impacts on Groundwater

6.87 The proposed increase in intake to the inert waste recovery facility has the potential to impact on groundwater in terms of both the groundwater quality and the groundwater flow regime. The potential impacts are considered qualitatively below:

Groundwater Quality

6.88 During the continued 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 during placement of inert fill and other operational procedures;
- increase in suspended solids and potential for contaminated runoff entering groundwater during development of the site; and
- deposition of rogue loads of contaminated material at the site.

6.89 There is a potential increase in risk to groundwater quality from these sources if there is increased site activity and increased level of traffic, associated with an increase in imported material.

6.90 Without mitigation, the probability of occurrence of spillage of fuels, lubricants and other potentially contaminative liquids (contaminated runoff) is '**high** due to the area of the site and number of vehicles that will use the site. The magnitude of such an impact would be '**moderate**'. Therefore, the overall risk to groundwater, without mitigation, is '***high***'.

6.91 Without mitigation, the probability of suspended solids in runoff entering groundwater is considered to be '**high**' due to the increase in volumes of material. The magnitude of the potential impact on groundwater is considered to be '**mild**', as mobilisation and transport of suspended solids requires a flow velocity greater than that usually achievable in the groundwater environment. Therefore the overall risk is '***medium***'.

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

Groundwater Flow / Recharge

6.93 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. The probability of occurrence is '**medium**'.

6.94 The available baseline information for the site indicates that:

(a) The pumping of water from sumps at the floor of the North quarry reduces groundwater throughput and diverts much of the existing groundwater recharge to surface water;

(b) it is likely that some rain falling over the backfilled quarries during and after backfilling operations will infiltrate as groundwater recharge and that the remainder will run-off over the restored landform to drainage channels feeding to the Ballystrahan Stream and then to the Ward River;

(c) the regional permeability of the unsaturated zone of the aquifer at Huntstown is moderately high, which will maintain regional groundwater flow direction around and beneath the backfilled quarries; and

(d) the reduction in, and ultimate cessation, of dewatering around the North Quarry as backfilling works progress will effect a local rise in groundwater level and contribute to increased flow around or beneath the quarry (though both level and flow would still be influenced by continued dewatering of the South Quarry).

6.95 It is considered that the net effect of any change to groundwater flow and recharge caused by a low permeability zone at the North and West quarries will be at least, if not fully, offset by a reduction and eventual cessation in dewatering activities at the quarry. The magnitude of the impact is therefore assessed as '**mild**' and the overall impact is considered to be '**low**'.

Potential Impacts on Surface Water

6.96 There are several permanent surface water features within the Huntstown Quarry complex including natural or modified watercourses and artificial features such as ditches, temporary channels, sumps and/or settlement ponds required for surface water management. It is considered that there is a potential short to medium-term risk that the increase in the rate of backfilling of the quarry void could result in waters with elevated suspended solids being discharged to existing watercourses. The probability of such an event occurring is considered to be '**high**' and the magnitude of impact is '**moderate**'. The overall impact on surface waters is therefore assessed as '***high***' if mitigation measures were not in place.

6.97 In the longer term, it is likely that some of the run-off from the completed landform will generally recharge to ground within the application site or run-off over the completed landform to the watercourse on the eastern side of the proposed recovery facility. The surface water run-off could potentially carry some suspended solids toward the watercourse. The probability of such an event occurring is considered to be '**high**' in the short term while vegetation is

established and the magnitude of impact is '**moderate**'. Therefore, the overall impact on surface waters is assessed as '***high***' if mitigation measures were not in place.

6.98 It is considered that the potential impact on surface water flow quantities arising from the increased rate of intake at the waste recovery facility is negligible and, as such, it is not considered further here.

Summary of Potential Impacts

6.99 A summary of potential impacts *without mitigation* is presented in Table 6-17 below.

Table 6-17
Summary of Unmitigated Risk and Magnitude of Potential Impacts

Potential Impact	Spatial Impact, Duration, Direct/Indirect	Probability of Occurrence	Magnitude of Impact	Significance of Impact	Mitigation Required?
Groundwater Quality					
Spillages of fuel	Local, Short Term, Direct	High	Moderate	High	Yes
Release of suspended solids	Local, Short-Term, Direct	High	Mild	Medium	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	Medium	Mild	Low	No
Reduction in recharge to aquifer	Local, Long Term and Direct	Medium	Mild	Low	No
Surface Water Quality					
Release of suspended solids during backfilling	Local, Short and Long Term, Direct	High	Moderate	High	Yes
Release of suspended solids post backfilling	Local, Short and Long Term, Direct	High	Moderate	High	Yes
Surface Water Quantity					
Capture of surface water runoff from the Tolka River catchment	Local, Long Term, indirect	High	Negligible	Low	No

6.100 Table 6-17 indicates that if no mitigation measures are applied to take account of the intensification of the quarry backfilling operation, there is potential for the activity to cause detrimental and direct impacts to the aquifer by increased risk of pollution to groundwater and creation of a low permeability zone to groundwater flow. The impacts are local to regional, and range from short-term to long-term. If the identified potential impact risk to either groundwater quality or groundwater flow were all to materialise, there would be a cumulative effect, which would increase the significance of the impact.

6.101 Similarly, in the absence of an effective surface water management system, the intensification of the quarry backfilling operation at the site has the potential to increase the risk of detrimental and direct impacts to the Ballystrahan Stream which flows northwards to the Ward River.

6.102 Any surface water runoff from the application site will go to the Ward River catchment. It is therefore recommended that the mitigation measures outlined in the following section are incorporated into the development proposal to reduce the potential impacts.

Do-Nothing Scenario

6.103 Much of the existing application site is already subject to a waste licence providing for the recovery of inert soil and stone materials. The licenced site currently comprises the North Quarry which is being backfilled with inert soil waste at present and continues to be actively dewatered.

6.104 Having undertaken a review of the available capacity and intake rates at similar recovery facilities across the Greater Dublin Area, Roadstone has identified that there is likely to be a significant constriction in available soil waste recovery capacity at authorised (i.e. permitted or licensed) facilities after it suspended intake to its Huntstown recovery facility, having reached its permitted annual intake limit at the end of July 2016. This assessment would be consistent with anecdotal reports from hauliers of a similar constriction in soil recovery capacity around Dublin in the final months of 2015.

6.105 In the absence of any increase in waste intake capacity at the existing licensed facility, it is likely that there will be a significant deficit in soil recovery capacity around the Greater Dublin Areas in the later months of 2016. As activity in the construction and development sectors recovers to normal levels in future years, it is expected that this deficit in recovery capacity would persist (in the absence of development of similar facilities at other locations).

6.106 In such circumstances, there would likely be an increased risk of unauthorised waste disposal activity around the region, at sites which are unlicensed and do not have the appropriate environmental safeguards and controls in place, with unknowable implication for local surface water and groundwater quality.

Interactions

6.107 It is considered that the groundwater and surface water at Huntstown are not interconnected at the present time and will not be once dewatering continues for the duration of the approved backfilling and restoration works. It is further considered that the headwaters of the Ballystrahan Stream are not in continuity with regional groundwater at the application site.

6.108 There are currently surface water discharges from the application site and these will continue to be maintained during the backfilling activities at the North Quarry and West Quarry.

MITIGATION MEASURES

6.109 Proposed mitigation measures required to reduce the potential impacts associated with the increased placement of material to acceptable levels with a low risk to the receiving environment, are identified in this section. These measures are designed to 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.

Existing and Proposed Mitigation Measures

6.110 In order to mitigate against the risk of pollution to groundwater and surface water occurring during the intensification of backfilling operations of the site, the following management measures will be included:

Existing Measures -

- A site specific traffic management system has been put in place to reduce the potential conflicts between vehicles, both in the quarry and in the wider quarry complex site where vehicles transit to the quarry, thereby reducing the risk of an accidental vehicle collision;
- the speed limit is enforced to further reduce the likelihood and significance of collisions between vehicles;
- all plant is regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids/liquors;
- refuelling of vehicles is undertaken at a surfaced area from a fuel tank(s) that is bunded or from a mobile double skinned fuel bowser in order to minimise the risk of uncontrolled release of polluting liquids / liquors;
- the maintenance of plant and machinery is undertaken within existing site maintenance sheds or off-site, as appropriate, to minimise the risk of uncontrolled release of polluting liquids;
- spill kits are available on-site to stop the migration of spillages, should they occur (see Appendix 6-E) for details of spill kit);
- soil and stone waste is vetted, inspected and tested to confirm it is inert prior to importation and deposition at the recovery facility. Waste handling procedures provide for classification, compliance and verification testing of waste intake (a copy of the waste handling and acceptance plan is provided in Appendix 2A for reference);
- all surface water run-off collected in sumps at the North Quarry and West Quarry goes to a settlement pond prior to discharge off-site to surface watercourses in order to reduce the concentration of suspended solids;

Proposed Measures -

- The existing waste recovery facility will continue to be run in accordance with best waste management practice, with the required plant and staff resources put in place to facilitate this;
- Progressive restoration of the inert material placed during backfilling will reduce the chance of suspended solids in the runoff being discharged to the receiving waters;
- The existing water treatment system at the site will be upgraded, as necessary (with provision of additional settlement pond capacity as required) to ensure that suspended solids in the off-site discharges are compliant within Emission Limit values set out in the Waste Licence; and

- Surface water runoff from the West Quarry area will be managed and diverted via existing water treatment infrastructure to the Ballystrahan Stream and Ward River catchment.

6.111 Taken together, these measures reduce the potential impact of

- spillage of fuels and lubricants from '*high*' to '*low*';
- an increase in suspended solids from '*medium*' to '*low';*
- contamination from rogue loads from '*medium to low*' to '*low*';
- release of suspended solids to surface water during placement from *high*' to '*low*'; and
- release of suspended solids to surface water following the cessation of placement from *high*' to '*low*';.

Monitoring

6.113 Monitoring measures have been implemented at the quarry complex and existing recovery facility in accordance with planning consents and waste licence requirements under the Waste Licence. These monitoring measures will continue at and around the application site in order to monitor any potential impact of the inert waste recovery operations on groundwater or surface water.

Groundwater Monitoring

6.114 Groundwater monitoring is being undertaken in accordance with Schedule C.5 of the waste Licence at GW01, GW02, GW03, GW04 and GW05. As noted previously, monitoring and sampling at GW06 has been suspended as no groundwater is intercepted by the well since the South Quarry was deepened.

6.115 The groundwater sampling schedule is set out in Schedule C of the existing Waste Licence, as shown in Table 6-18 below.

Table 6-18
Groundwater Monitoring Schedule from Waste Licence

Parameter	Monitoring Frequency	Analysis Method / Technique
Groundwater Level	Quarterly	Standard Method
Visual Inspection	Quarterly	Standard Method
pH	Quarterly	pH Electrode/meter
Conductivity	Quarterly	Standard Method
Ammonia as N	Biannually	Standard Method
Orthophosphate as P	Biannually	Standard Methods
Total Dissolved Solids	Biannually	Standard Method
Dissolved Metals	Annually	Standard Method
Total Petroleum Hydrocarbons	Annually	Standard Method
Diesel Range Organics	Annually	Standard Method
Petrol Range Organics	Annually	Standard Method
Total Coliforms	Annually	Standard Method
Faecal Coliforms	Annually	Standard Method

6.116 The existing groundwater monitoring regime will remain in place for the duration of the quarry backfilling and restoration works until such time as the Waste Licence is ultimately surrendered.

Surface Water Monitoring

6.117 Surface water at the application site is currently tested for a range of physical and chemical parameters in line with the discharge licence and Waste Licence requirements.

6.118 Surface water sampling and chemical testing will be undertaken as per the requirements of the existing Waste Licence for the site. The surface water test parameters and monitoring frequency are set out in Schedule C of the Waste Licence and is shown in Table 6-19 below.

Table 6-19
Surface Water Monitoring Schedule from Waste Licence

Parameter	Monitoring Frequency	Analysis Method / Technique
Visual Inspection	Daily	Examine colour and odour
Flow	Daily	Flow meter
Temperature	Weekly	Temperature probe
pH	Weekly	pH Electrode/meter
BOD	Weekly	Standard Method
Suspended solids (mg/l)	Weekly	Standard Method
Ammonia as N	Weekly	Standard Method
Orthophosphate as P	Weekly	Standard Method
Dissolved Metals (Cd, Cu, Fe, Pb, Mg, Mn, Ni and Zn)	Quarterly	Standard Method
Total Dissolved Solids	Quarterly	Standard Method
Total Petroleum Hydrocarbons	Biannually	Standard Method
Diesel Range Organics	Biannually	Standard Method
Petrol Range Organics	Biannually	Standard Method

6.119 The emission limit values for the discharge to surface water are set out in Schedule B of the Waste Licence and are shown in Table 6-20 below. These limits will continue to apply if the rate of waste intake is increased.

Table 6-20
Surface Water Emission Limit Values

Parameter	Unit	Emission Limit Value
Temperature	^{o}C	25
pH	pH units	6 - 9
BOD	mg/l	5
Suspended Solids	mg/l	15
Ammonia as N	mg/l	0.5
Orthophosphate as P	mg/l	0.5

6.120 The surface water monitoring regime will remain in place for the duration of the quarry backfilling and restoration works until such time as the Waste Licence is ultimately surrendered.

RESIDUAL IMPACTS

6.121 A summary of the proposed mitigation methods, together with the predicted effects and residual impacts is presented overleaf in Table 6-21.

6.122 Examination of the identified potential impacts on the receiving environment with mitigation measures in place (refer to Table 6-21) confirms that there are no significant residual impacts with respect to groundwater and/or surface water provided the appropriate mitigation measures are undertaken.

6.123 It is therefore considered that the proposed increase in intake of inert waste to the recovery facility in this location is acceptable and there will be no significant impact on groundwater and/or surface water.

Table 6-21
Summary of Mitigation and Residual Impacts at Huntstown

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	High	Moderate	High	Yes	Traffic systems, speed limits, maintenance, refuelling measures, tank bunding and spill kits	Low	Moderate	Low
Release of suspended solids	Local, Long Term, Direct	High	Mild	Medium	Yes	Silt reduction measures through surface water management including treatment with stone filters on channels, settlement pond and progressive restoration.	Low	Mild	Low
Rogue load of contaminated material	Local, Short Term, Direct	Medium	Mild to Moderate	Low to Medium	Yes	Inspection and testing of waste loads. Testing to include classification, compliance and verification testing of the waste intake.	Low	Mild to Moderate	Low
Groundwater Flow / Recharge to Aquifer									
Impermeable barrier to groundwater flow	Local, Long Term, Direct	Medium	Mild	Low	No	-	-	-	-
Reduction in recharge to aquifer	Local, Long Term and Direct	Medium	Mild	Low	No	-	-	-	-

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
Surface Water Quality									
Release of suspended solids during backfilling	Local, Short and Long Term, Direct	High	Moderate	High	Yes	Silt reduction measures through surface water management including treatment with stone filters on channels, settlement pond and progressive restoration. Up grading of existing surface water treatment if required	Low	Mild	Low
Release of suspended solids post backfilling	Local, Short and Long Term, Direct	High	Moderate	High	Yes	Progressive restoration across the site to reduce the areas of bare soils where suspended solids could be generated during storm events.	Low	Mild	Low
Surface Water Quantity									
Capture of surface water runoff from the Tolka River catchment	Local, Long Term, indirect	High	Negligible	Low	No				

CONCLUSIONS

6.124 The groundwater and surface water regimes at the application site have been assessed with reference to information held by the Geological Survey of Ireland, the Environmental Protection Agency and others. This information has been supplemented with site specific investigation information including monitoring results from the site and the existing licenced waste facility.

6.125 The potential impacts of the proposed increase in the intake of inert material to the existing development upon hydrogeological and hydrological environment have been identified and assessed, and where appropriate, mitigation measures have been incorporated into the design of the development.

FIGURES

N

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B.**

2. ORDNANCE SURVEY IRELAND LICENCE NO. **SU 0000716 (C)** ORDNANCE SURVEY & GOVERNMENT OF IRELAND

LEGEND

- ROADSTONE LIMITED LAND INTEREST **(c. 200.3 ha)**
- APPLICATION AREA **(c. 48.65 ha)**
- N2 DUAL CARRIAGEWAY
- NORTH ROAD (R135)
- LOCAL ROAD
- M50 MOTORWAY
- GROUNDWATER MONITORING WELLS (GROUNDWATER LEVEL 13/01/2016 mOD)
- INTERPRETED GROUNDWATER LEVEL CONTOUR (13/01/2016) - WINTER MAXIMUM LEVEL
- SEMI-PERMANENT / EPHEMERAL PONDS IN WEST QUARRY (JUNE 2016)

60mOD
40mOD
50mOD
70mOD
GW04 (62.43)
GW03 (66.76)
GW05(83.93)
80mOD
70mOD
GW02 (79.12)
70mOD
60mOD
GW01(54.04)
50mOD
40mOD
30mOD
VIRIDIAN POWER STATION
EXCLUDED - NOT OWNED BY ROADSTONE LIMITED
APPOGE
capach

0 100 200 300 400m 600 800 1000
Metres 1:10,000

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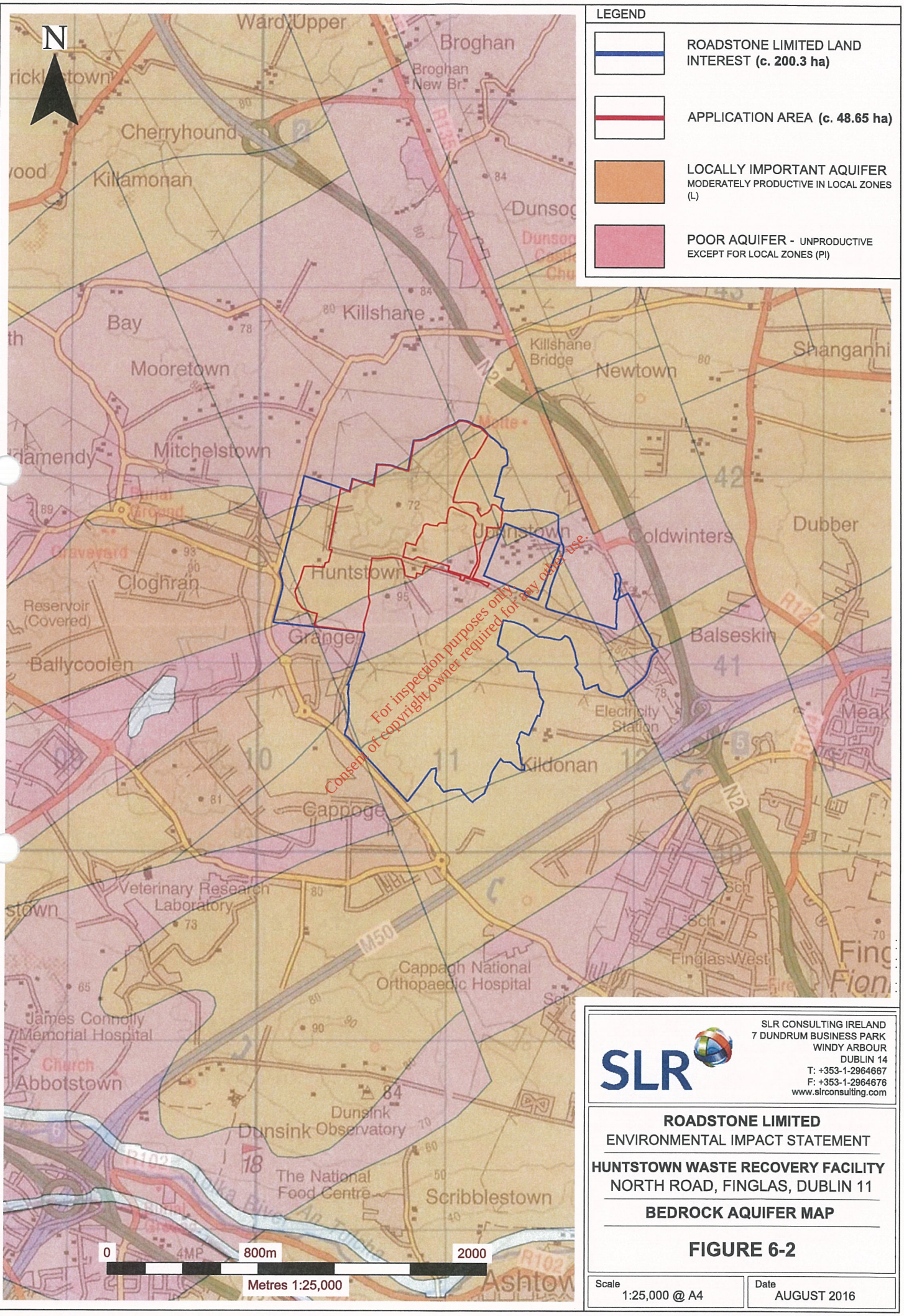
ROADSTONE LIMITED
ENVIRONMENTAL IMPACT STATEMENT
HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11
GROUNDWATER CONTOURS (JAN 2016)

FIGURE 6-1

Scale: 1:10,000 @ A3
Date: AUGUST 2016

0180.00152.0.FIG_6-1.Groundwater Contour Map.dwg



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HUNTSTOWN WASTE RECOVERY FACILITY

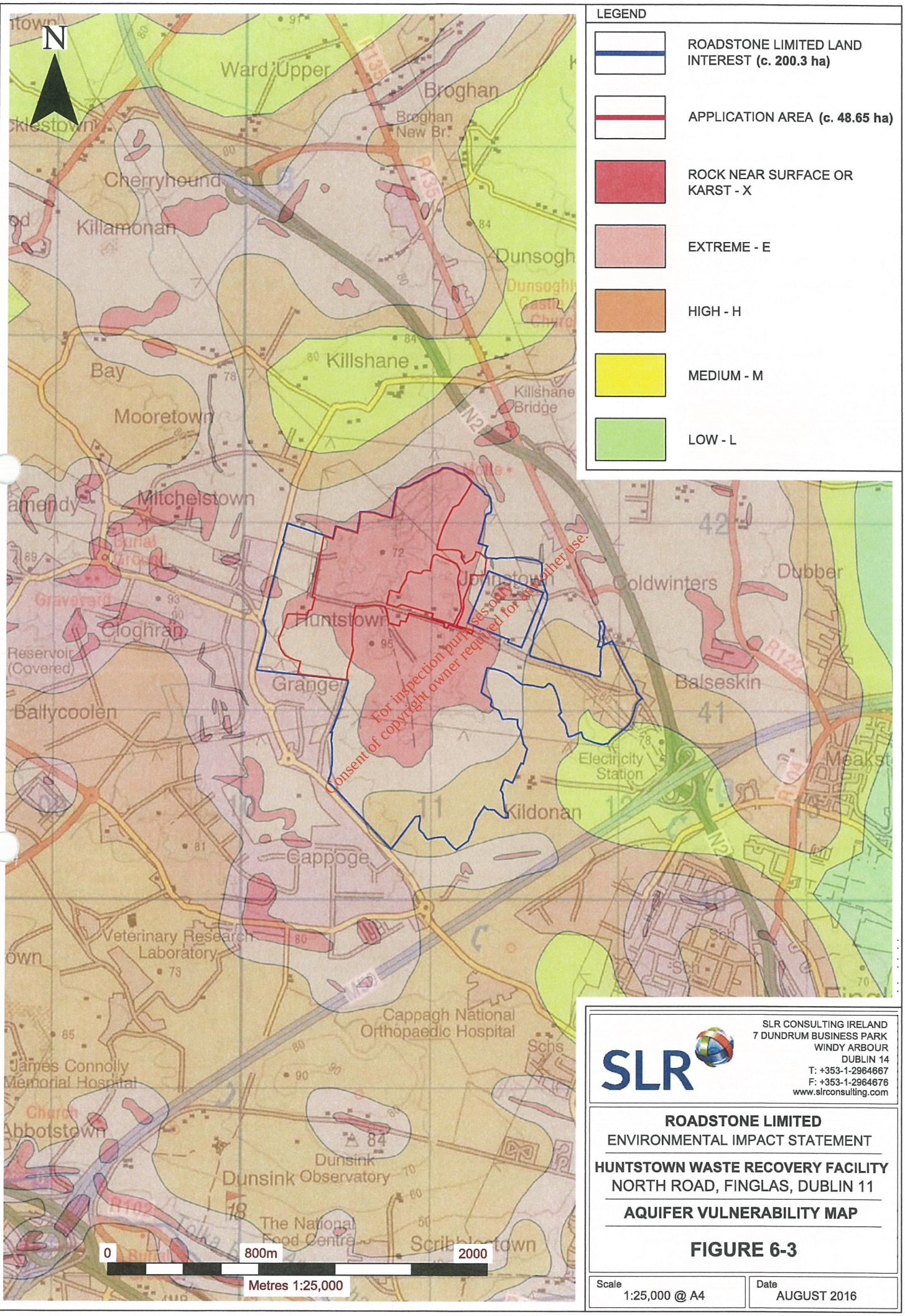
NORTH ROAD, FINGLAS, DUBLIN 11

BEDROCK AQUIFER MAP

FIGURE 6-2

Scale	Date
1:25,000 @ A4	AUGUST 2016

0180.00152.0.FIG_6-2.Bedrock Aquifer Map.dwg



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HUNTSTOWN WASTE RECOVERY FACILITY

NORTH ROAD, FINGLAS, DUBLIN 11

AQUIFER VULNERABILITY MAP

FIGURE 6-3

Scale	Date
1:25,000 @ A4	AUGUST 2016

0180.00152.0.FIG_6-3.Aquifer Vulnerability Map.dwg

Ballystraham Stream

Pumped Discharge from Quarry Floor

Settlement Pond with reeds

Discharge Monitoring (Downstream)

Discharge Monitoring (Upstream)

Discharge Monitoring (Weir)

GW01

GW02

GW03

GW04

GW05

GW06

W1

W2

W3

W4

DL

DL

VIRIDIAN POWER STATION
(EXCLUDED - NOT OWNED BY ROADSTONE LIMITED)

Southern Quarry Discharge Monitoring Location

N

0 100 200 300 400m 600 800 1000

Metres 1:10,000

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B.**

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- APPLICATION AREA **(c. 48.65 ha)**
- M50 MOTORWAY
- N2 DUAL CARRIAGEWAY
- NORTH ROAD (R135)
- LOCAL ROAD
- GROUNDWATER MONITORING WELLS
- W3 — SURFACE WATER MONITORING LOCATION
- W4 — SURFACE WATER MONITORING LOCATION FOR WASTE LICENCE
- DL — DISCHARGE LICENCE MONITORIONG LOCATION (UPSTREAM AND DOWNSTREAM)
- W1 — DISCHARGE MONITORING LOCATION FOR DISCHARGE LICENCE
- SEMI-PERMANENT / EPHEMERAL PONDS IN WEST QUARRY (JUNE 2016)

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ENVIRONMENTAL IMPACT STATEMENT

HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11

WATER MONITORING MAP

FIGURE 6-5

Scale: 1:10,000 @ A3

Date: AUGUST 2016

0180.00152.0.FIG_6-5.Water Monitoring Map.dwg

N

VIRIDIAN POWER STATION
EXCLUSIVE, NOT OWNED BY ROADSTONE LIMITED

CAPPOGE
Ceapach

0 100 200 300 400m 600 800 1000

Metres 1:10,000

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B.**

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LEGEND

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- APPLICATION AREA **(c. 48.65 ha)**
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- N2 DUAL CARRIAGEWAY
- NORTH ROAD (R135)
- LOCAL ROAD
- WARD RIVER CATCHMENT
- TOLKA RIVER CATCHMENT

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HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11

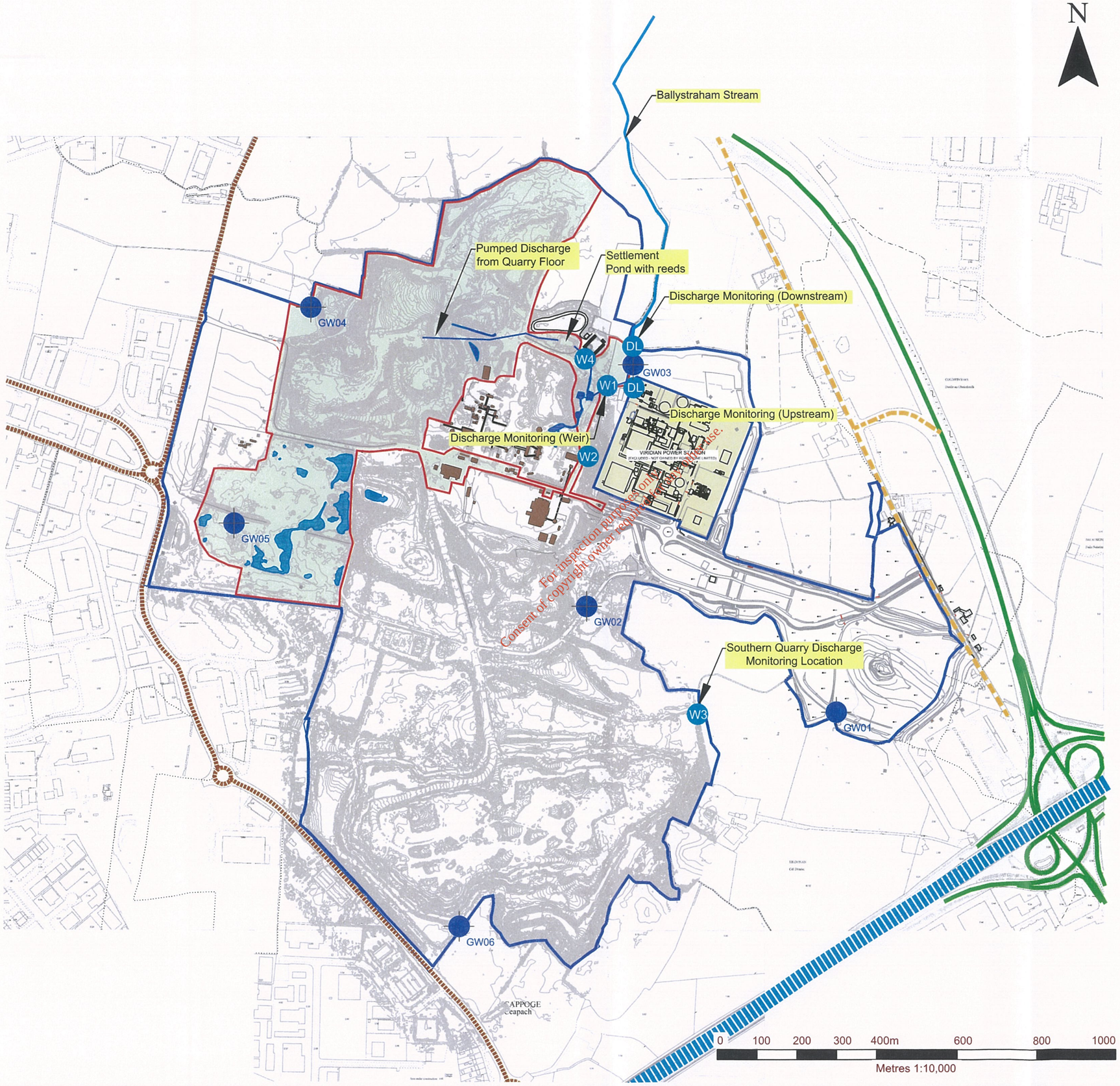
RIVER CATCHMENTS MAP

FIGURE 6-4

Scale: 1:10,000 @ A3

Date: AUGUST 2016

0180.00152.0.FIG_6-4.River Catchments Map.dwg



NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B**.

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- SEMI-PERMANENT / EPHEMERAL PONDS IN WEST QUARRY (JUNE 2016)

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ENVIRONMENTAL IMPACT STATEMENT

HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11

WATER MONITORING MAP

FIGURE 6-5

Scale	Date
1:10,000 @ A3	AUGUST 2016

0180.00152.0.FIG_6-5.Water Monitoring Map.dwg

N

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B.**

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LEGEND

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- APPLICATION AREA **(c. 48.65 ha)**
- M50 MOTORWAY
- N2 DUAL CARRIAGEWAY
- NORTH ROAD (R135)
- LOCAL ROAD
- SWORDS GROUNDWATER BODY
- DUBLIN GROUNDWATER BODY

VIRIDIAN POWER STATION (EXCLUDED - NOT OWNED BY ROADSTONE LIMITED)

0 100 200 300 400m 600 800 1000

Metres 1:10,000

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ENVIRONMENTAL IMPACT STATEMENT

HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11

WATER FRAMEWORK DIRECTIVE GROUNDWATER BODIES

FIGURE 6-6

Scale 1:10,000 @ A3

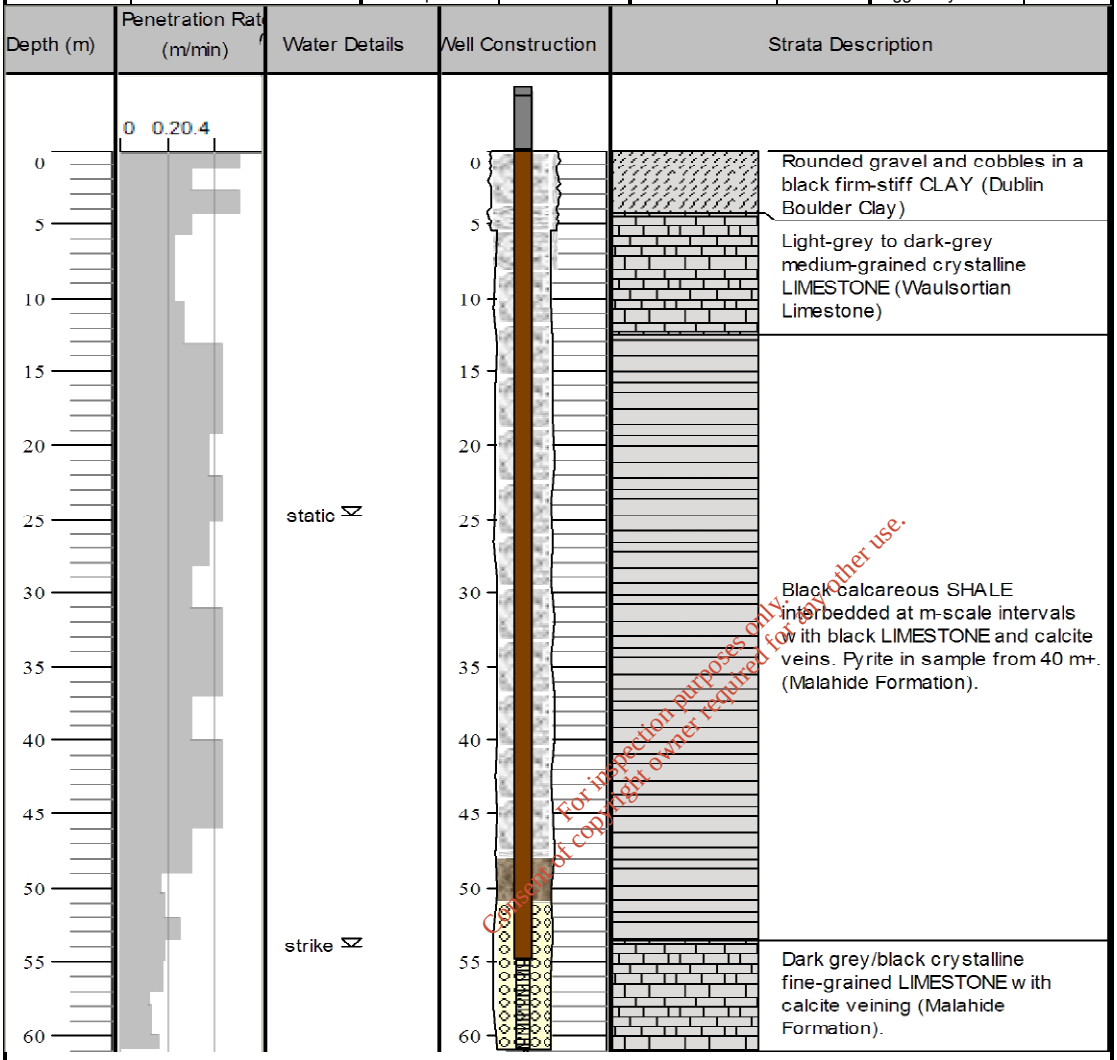
Date AUGUST 2016

0180.00152.0.FIG_6-6.Groundwater Bodies Map.dwg

APPENDICES

APPENDIX 6-A
GROUNDWATER WELL CONSTRUCTION RECORDS

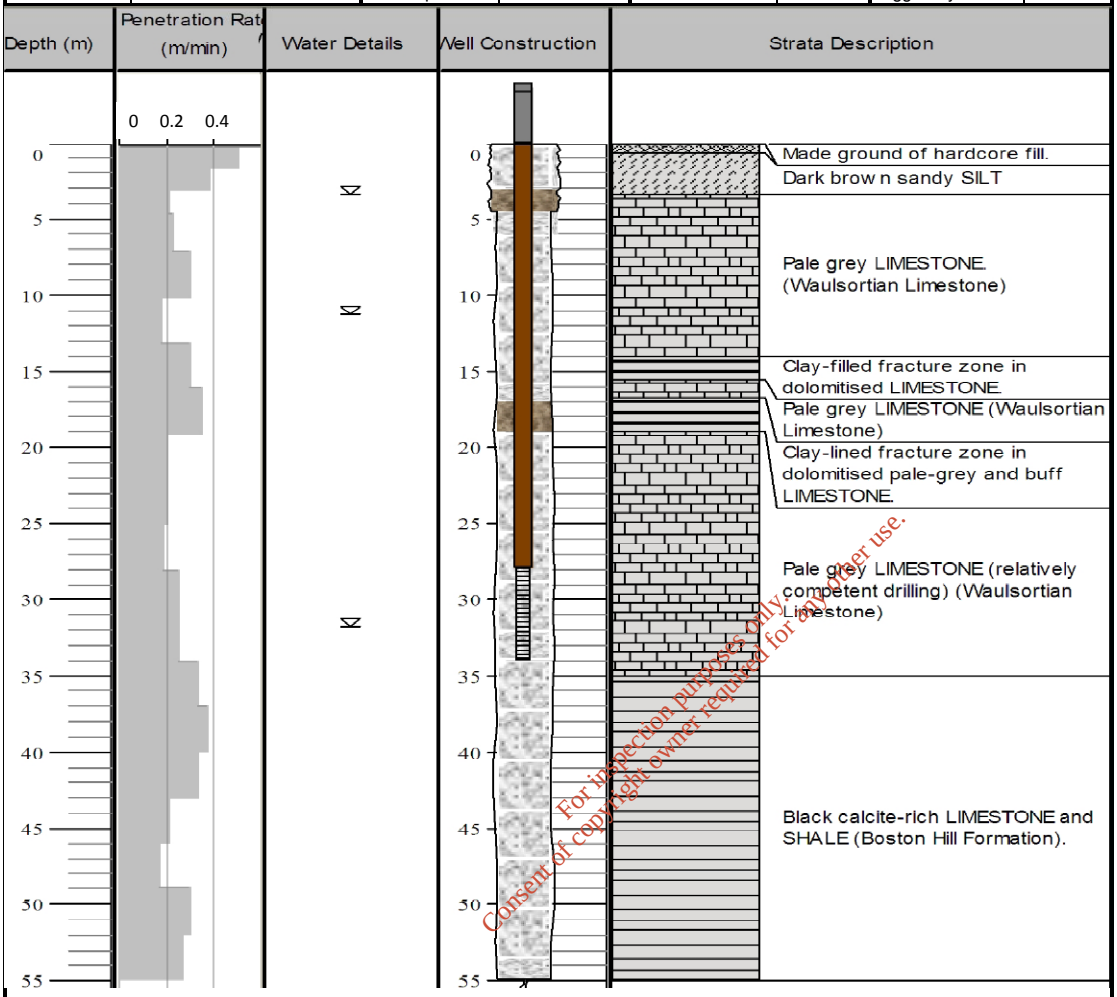
Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd.	Well Name	GW01	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	311785.7	Dublin 14			
Contractor	Petersen Drilling Services	Northing	240902.1	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	80.98 mOD	Casing Length	55 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	81.74 mOD	Casing Diameter	50 mm	Static Level	24.7 mbgl
Start Date	17-Jul-10	Boring Depth	61 m	Screen Length	6 m	Depth to Bedrock	4.3 mbgl
End Date	20-Jul-10	Well Depth	61 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0	5.5				
0.14	5.5	61				

Other Remarks:

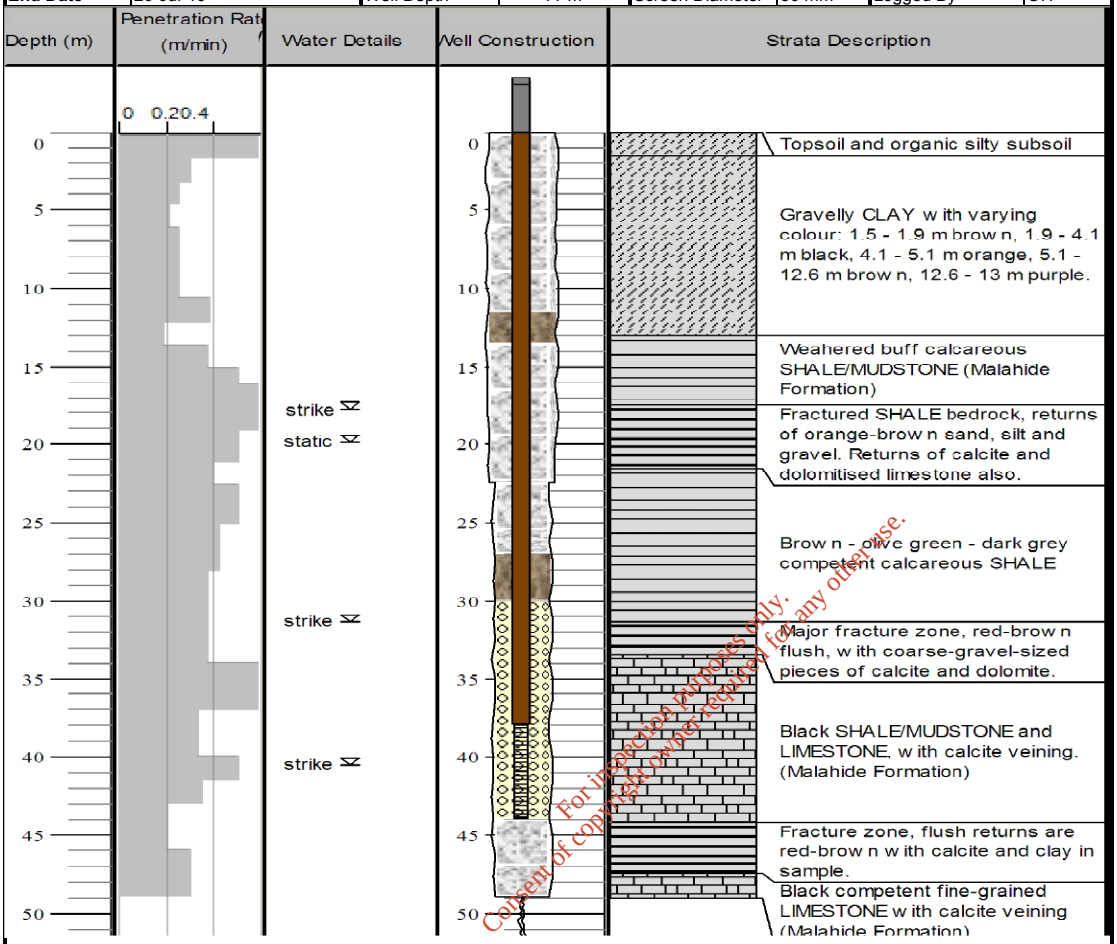
Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd.	Well Name	GW02	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	311158.0	Dublin 14			
Contractor	Petersen Drilling Services	Northing	241167.5	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	81.51 mOD	Casing Length	28 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	82.33 mOD	Casing Diameter	50 mm	Static Level	11.2mbgl
Start Date	17-Jul-10	Boring Depth	55 m	Screen Length	6 m	Depth to Bedrock	3.4 mbgl
End Date	20-Jul-10	Well Depth	34 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0	4.5				
0.14	4.5	55				

Other Remarks:

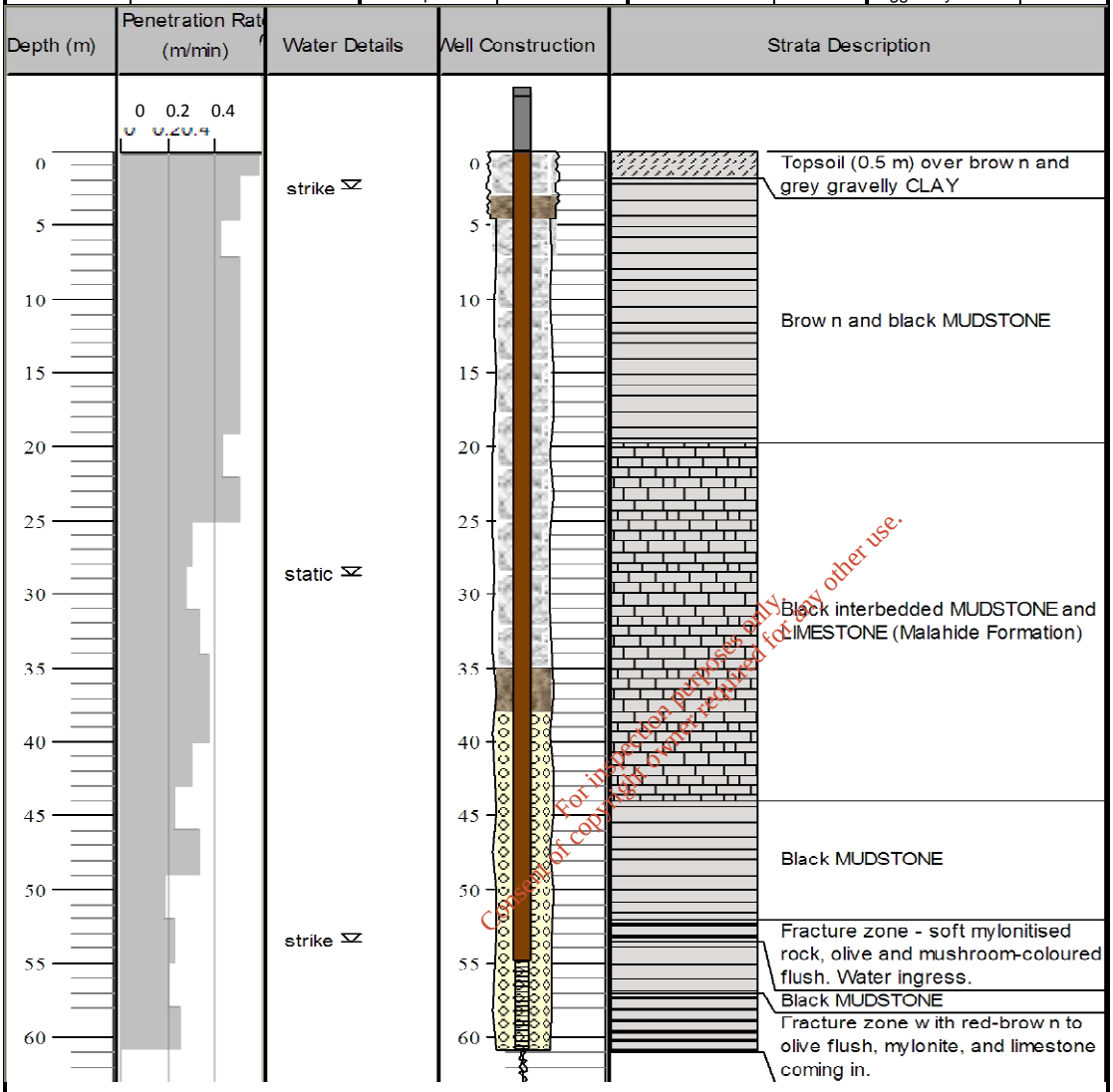
Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd.	Well Name	GW03	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	311274.1	Dublin 14			
Contractor	Petersen Drilling Services	Northing	241775.0	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	77.94 mOD	Casing Length	38 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	78.47 mOD	Casing Diameter	50 mm	Static Level	19.9 mbgl
Start Date	17-Jul-10	Boring Depth	49 m	Screen Length	6 m	Depth to Bedrock	13 mbgl
End Date	20-Jul-10	Well Depth	44 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0	22.5				
0.14	22.5	49				

Other Remarks:

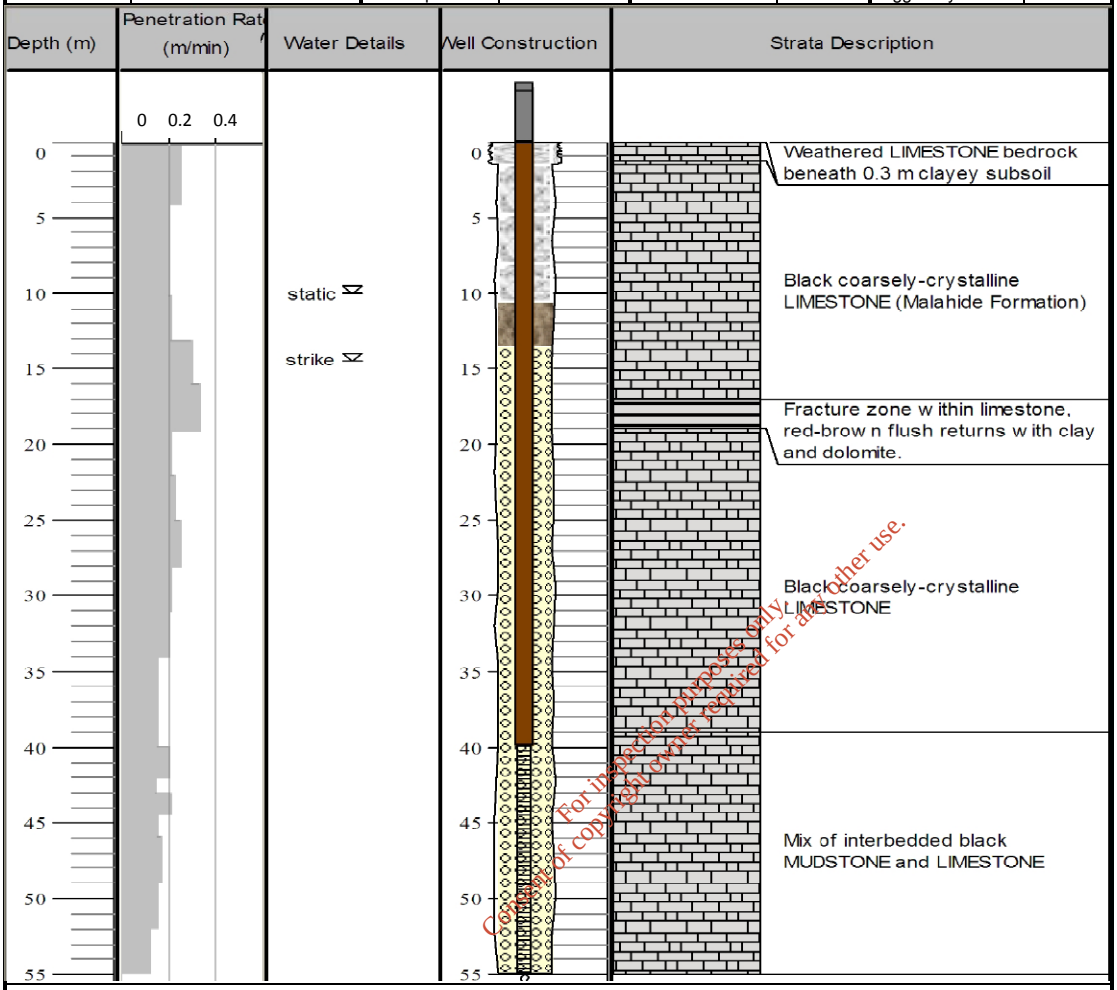
Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd.	Well Name	GW04	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	310466.2	Dublin 14			
Contractor	Petersen Drilling Services	Northing	241917.7	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	81.21 mOD	Casing Length	55 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	81.73 mOD	Casing Diameter	50 mm	Static Water Level	28.7 mbgl
Start Date	17-Jul-10	Boring Depth	61 m	Screen Length	6 m	Depth to Bedrock	1.9 mbgl
End Date	20-Jul-10	Well Depth	61 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0	4.5				
0.14	4.5	61				

Other Remarks:

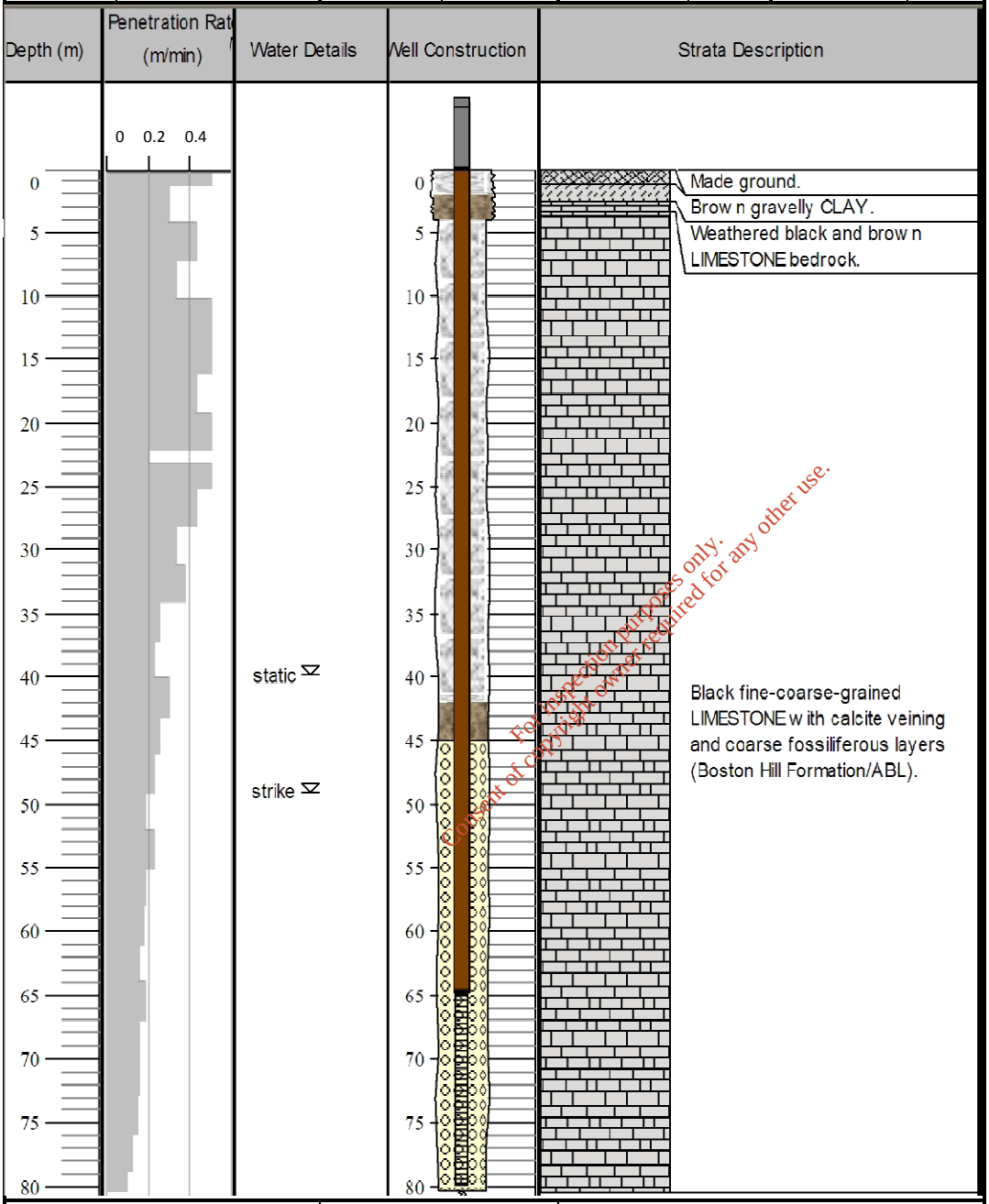
Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd	Well Name	GW05	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	310273.0	Dublin 14			
Contractor	Petersen Drilling Services	Northing	241374.9	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	84.95 mOD	Casing Length	40 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	85.33 mOD	Casing Diameter	50 mm	Static Level	10 mbgl
Start Date	17-Jul-10	Boring Depth	55 m	Screen Length	15 m	Depth to Bedrock	0.3 mbgl
End Date	20-Jul-10	Well Depth	55 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0					
0.14						

Other Remarks:
Approximately 2.5 m of soil and subsoil have been stripped from this area.

Project Name	Huntstown Quarry PA	**WELL LOG**		SLR Consulting (Ireland) Ltd.			
Client	Roadstone Wood Ltd	Well Name	GW06	7 Dundrum Business Park			
Project No.	501.0180.00011			Windy Arbour			
Location	Huntstown, County Dublin	Easting	310847.3	Dublin 14			
Contractor	Petersen Drilling Services	Northing	240902.1	T: 01 2964667 F: 01 2964676			
Drill Rig	Knebel	Elevation (gl)	82.16 mOD	Casing Length	65.5 m	Hole ID	170 mm
Drill Method	Symmetrix and DTH Air	Elevation (TOC)	82.78 mOD	Casing Diameter	50 mm	Static Level	39.8 mbgl
Start Date	17-Jul-10	Boring Depth	80.5 m	Screen Length	15 m	Depth to Bedrock	2.5 mbgl
End Date	20-Jul-10	Well Depth	80.5 m	Screen Diameter	50 mm	Logged By	OH



Drilling Diameters			**Steel Support Casings**			Driller Yield Estimate:
Diameter	From	To	Diameter	From	To	Development Time:
0.17	0	4				
0.14	4	80.5				

Other Remarks:

APPENDIX 6-B
MET EIREANN RAINFALL RETURN PERIODS DDF

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 311201, Northing: 241045,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.6,	4.2,	5.1,	5.6,	6.1,	7.6,	9.3,	10.4,	12.0,	13.4,	14.5,	16.2,	17.5,	18.6,	N/A ,
10 mins	3.6,	5.0,	5.8,	7.0,	7.9,	8.5,	10.6,	13.0,	14.5,	16.7,	18.7,	20.2,	22.6,	24.4,	26.0,	N/A ,
15 mins	4.2,	5.9,	6.9,	8.3,	9.3,	10.0,	12.5,	15.2,	17.1,	19.7,	22.0,	23.8,	26.6,	28.8,	30.6,	N/A ,
30 mins	5.5,	7.7,	8.9,	10.7,	11.9,	12.8,	15.8,	19.2,	21.4,	24.5,	27.3,	29.4,	32.7,	35.3,	37.4,	N/A ,
1 hours	7.3,	10.1,	11.6,	13.7,	15.2,	16.3,	20.0,	24.1,	26.8,	30.5,	33.8,	36.4,	40.3,	43.3,	45.8,	N/A ,
2 hours	9.7,	13.2,	15.0,	17.7,	19.5,	20.9,	25.4,	30.3,	33.6,	38.0,	42.0,	45.0,	49.6,	53.2,	56.1,	N/A ,
3 hours	11.4,	15.4,	17.5,	20.5,	22.6,	24.1,	29.1,	34.7,	38.3,	43.2,	47.6,	50.9,	56.0,	60.0,	63.2,	N/A ,
4 hours	12.8,	17.2,	19.5,	22.8,	25.0,	26.7,	32.2,	38.1,	42.0,	47.4,	52.1,	55.6,	61.1,	65.3,	68.7,	N/A ,
6 hours	15.1,	20.1,	22.6,	26.4,	28.9,	30.8,	36.9,	43.6,	47.9,	53.9,	59.0,	63.0,	69.0,	73.6,	77.3,	N/A ,
9 hours	17.7,	23.4,	26.4,	30.6,	33.4,	35.6,	42.4,	49.9,	54.7,	61.2,	67.0,	71.3,	77.9,	83.0,	87.1,	N/A ,
12 hours	19.9,	26.2,	29.4,	34.0,	37.1,	39.4,	46.8,	54.9,	60.0,	67.1,	73.2,	77.9,	84.9,	90.3,	94.7,	N/A ,
18 hours	23.4,	30.6,	34.2,	39.4,	42.9,	45.5,	53.8,	62.7,	68.4,	76.3,	83.0,	88.2,	95.9,	101.8,	106.6,	N/A ,
24 hours	26.3,	34.1,	38.1,	43.8,	47.5,	50.4,	59.3,	69.0,	75.1,	83.5,	90.8,	96.3,	104.6,	110.9,	116.0,	133.5,
2 days	32.6,	41.5,	46.0,	52.3,	56.5,	59.6,	69.3,	79.8,	86.3,	95.3,	102.9,	108.7,	117.3,	123.8,	129.2,	147.1,
3 days	37.7,	47.5,	52.3,	59.2,	63.7,	67.0,	77.5,	88.5,	95.5,	104.9,	112.9,	118.9,	128.0,	134.8,	140.3,	158.8,
4 days	42.1,	52.6,	57.8,	65.2,	69.9,	73.5,	84.5,	96.2,	103.5,	113.3,	121.7,	127.9,	137.3,	144.3,	150.0,	169.2,
6 days	49.9,	61.7,	67.5,	75.6,	80.8,	84.7,	96.8,	109.5,	117.3,	127.9,	136.8,	143.5,	153.5,	161.0,	167.0,	187.2,
8 days	56.8,	69.7,	76.0,	84.8,	90.4,	94.6,	107.5,	121.0,	129.4,	140.6,	150.1,	157.1,	167.6,	175.5,	181.8,	203.0,
10 days	63.1,	77.0,	83.7,	93.1,	99.0,	103.5,	117.2,	131.5,	140.3,	152.1,	162.0,	169.4,	180.4,	188.6,	195.2,	217.1,
12 days	69.0,	83.7,	90.8,	100.8,	107.1,	111.8,	126.2,	141.2,	150.4,	162.7,	173.0,	180.7,	192.1,	200.6,	207.5,	230.2,
16 days	80.0,	96.2,	104.0,	114.9,	121.8,	127.0,	142.7,	158.8,	168.8,	182.0,	193.1,	201.3,	213.5,	222.6,	229.8,	254.0,
20 days	90.1,	107.7,	116.2,	127.9,	135.3,	140.9,	157.7,	174.9,	185.5,	199.5,	211.3,	220.0,	232.9,	242.4,	250.1,	275.5,
25 days	101.9,	121.1,	130.3,	143.0,	151.0,	157.0,	175.0,	193.5,	204.8,	219.7,	232.2,	241.5,	255.1,	265.2,	273.3,	300.1,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation_of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX 6-C
DISCHARGE LICENCE WPW/F/008-01

COMHAIRLE CONTAE FHINE GALL

FINGAL COUNTY COUNCIL

LICENCE TO DISCHARGE TRADE EFFLUENT TO WATERS

To: Roadstone Wood Ltd.,
Fortunestown,
Tallaght,
Dublin 24.

Ref. Number in Register: **WPW/F/008 - 01**

Fingal County Council (hereinafter referred to as "the Council") in exercise of the powers conferred on it by the Local Government (Water Pollution) Acts 1977 and 1990, hereby grants a Licence, Reference Number WPW/F/008 - 01 to Roadstone Wood Ltd., (hereinafter referred to as "Licensee") to discharge trade effluent to waters from their premises at Huntstown Quarry, Ashbourne Road, Finglas, Dublin 11, subject to the following conditions:-

1. The temperature of the treated effluent shall not exceed **25 degrees Centigrade**, or **ambient temperature** if it exceeds **25 degrees Centigrade.**

2. The **pH** of the treated effluent shall lie in the range **6.0 to 9.0.**
The **pH** of the receiving waters shall not be altered by more than **+/- 0.5 pH** units by the effluent discharge.

3. Over any 24 hour period, the mean concentration of **biochemical oxygen demand (B.O.D.)** in the effluent shall not exceed **5 mg/litre** 0_2 and the maximum concentration of **B.O.D.** shall not exceed **7 mg/litre** 0_2. The total quantity of biochemical oxygen demand discharged in this period shall not exceed **9.0 Kgs.**

4. Over any 24 hour period, the mean concentration of **chemical oxygen demand (C.O.D.)** in the effluent shall not exceed **30 mg/litre** and the maximum concentration of **C.O.D.** shall not exceed **50 mg/litre**. The total quantity of chemical oxygen demand discharged in this period shall not exceed **54.0 Kgs.**

5. Over any 24 hour period, the mean concentration of suspended solids in the effluent shall not exceed **20 mg/litre** and the maximum concentration of **suspended solids** shall not exceed **30 mg/litre**. The total quantity of suspended solids discharged in this period shall not exceed **36.0 Kgs.**

6. The concentration of mineral oils in the effluent shall not exceed **10.0** mg/l.
The total quantity of mineral oils discharged per day shall not exceed **18.0 Kgs.**

Petroleum hydrocarbons shall not be present in the effluent which would :

(a) Form a visible film on the receiving water surface or form coatings on the sub-stratum.
(b) Impart a detectable hydrocarbon taste to edible finfish and/or shellfish.
(c) Cause deleterious effects on aquatic life.

7. The concentration of detergents in the effluent shall not exceed **10.0 mg/l.**
The total quantity of detergents discharged per day shall not exceed **18.0 Kgs.**

8. The concentration of **Ammonium (as N)** in the effluent shall not exceed **1 mg/l as N.**
The total quantity of **Ammonium** discharged per day shall not exceed **1.8 Kg as N.**

9. The concentration of **Phosphates (as PO_4-P)** in the effluent shall not exceed **1 mg/l as P.**
The total quantity of **Phosphates** discharged per day shall not exceed **1.8 Kg as P.**

10. The concentration of **Sulphates (as SO_4)** in the effluent shall not exceed **300 mg/l.**
The total quantity of **Sulphates** discharged per day shall not exceed **540.0 Kgs as SO_4.**

11. Over any 24 period, the maximum volume of effluent discharged shall not exceed **1,800 cubic metres.**

12. Materials classifiable as Hazardous Waste under the Waste Management Acts, shall not be discharged to waters.

13. Other wastewaters (including firewater, accidental spillages etc.) arising on the site shall not be discharged to waters without prior authorisation of Fingal County Council.

14. The effluent discharged shall be of the same nature and composition as described and conditioned in this licence. The effluent shall contain no other substances in such a concentration, nor to be discharged in such a manner as to be harmful or detrimental to public health or to domestic, commercial, industrial agricultural or recreational uses of the receiving waters.

15. All storage tanks for fuel and/or chemicals shall be surrounded by a bund capable of retaining 110% of the volume of the largest single tank within the bunded area. The intake and outlet for the tanks shall be positioned inside the bund. Provision shall be made to remove and dispose of the rainwater so as to ensure the specified volume is always available within the bund. The bund shall be constructed and maintained by the Licensee to specifications agreed with Fingal County Council.

16. The Licensee shall keep records, in such form as required, of volume, rate of discharge, nature and composition of the trade effluent discharged and these shall be available at all reasonable times for inspection by duly authorised persons as defined in Section 28(9) of the Local Government (Water Pollution) Acts 1977 & 1990. Copies of such records shall be sent to the Council on demand.

17. A record or log-book of cleaning, maintenance and performance of each settling tank shall be kept and made available for inspection at all times by duly authorised persons as defined in Section 28(9) of the Local Government (Water Pollution) Acts 1977 & 1990.

18. The Licensee shall display in a prominent position a notice to the effect that in the event of an accidental discharge, spillage or deposit of any polluting matter which enters or is likely to enter any waters or a sewer, the person responsible shall notify the Council as soon as practicable after the occurrence and the and that failure to do so is an offence under Section 14, Local Government (Water Pollution) Acts 1977 & 1990.

19. A fee of **€205.00** per sample collected by the Fingal County Council representative for compliance monitoring is payable to Fingal County Council, this charge covers the cost of sample collection and chemical analysis and is payable on demand.

20. The Licensee shall monitor the discharge of treated effluent to ensure compliance with the conditions of this licence. Representative samples of the **treated final effluent and the upstream and downstream receiving waters** shall be taken by the Licensee and tested for the chemical and physical characteristics conditioned in this licence using standard methods. The frequency of sampling shall be as necessary but shall not be less than **12 times per year (monthly).**

    The costs of all such tests shall be borne by the Licensee.

21. The applicant shall permit authorised persons as defined in Section 28(9) of the Local Government (Water Pollution) Acts 1977 & 1990 as Amended, to inspect, examine and test, at all reasonable times, any works and apparatus installed in connection with the trade effluent and to take samples of the trade effluent.

22. The Licensee shall submit monitoring results to Fingal County Council on an annual basis, but not later than **January 15th** for the previous year.

23. Failure to comply with any of these conditions will result in prosecution under section 16(9) of the Local Government (Water Pollution) Acts 1977 & 1990. A conviction could result in substantial fines (up to €5,000) and/or imprisonment.

Joseph Mahon
Authorised Officer

Dated this 24th day of Nov. 2011

APPENDIX 6-D
WATER QUALITY RESULTS

				Location	V-Notch North	V-Notch North	V-Notch North	V-Notch North	V-Notch North
Parameter	Discharge Licence Limits	Waste Licence Emission Limits (W4)	Units	Sample ID	125543	125674	125862	126433	126545
				No. Samples	18/11/2015	24/11/2015	02/12/2015	08/01/2016	13/01/2016
Ammoniacal Nitrogen			mg/l	14	<0.08	0.26	<0.08	<0.08	<0.08
BOD	5	5	mg/l	14	2	<2	<2	<2	<2
Orthophosphate as P		0.5	mg/l	12	<0.33	<0.33	<0.33	<0.33	<0.33
pH	6.0-9.0	6.0-9.0	pH Units	14	8.1	7.8	8.1	8.0	8.0
Suspended Solids	20	15	mg/l	14	13	4	15	10	11
Temperature oC	25	25	^{o}C	14	11	10	12	18	5
COD	30		mg/l	4	8				8
Detergents as MBAS	10		mg/l	4	<0.05				<0.05
Dissolved Oxygen	6		mg/l	4	9.3				9.6
Mineral Oil	10		mg/l	4	0.021				<0.010
Phosphate as P	1		mg/l	4	<0.33				<1
Sulphate	300		mg/l	4	321				280
Ammonia as NH4	1	0.5	mg/l	2	<0.10				<0.10
Zinc			mg/l	1					<0.01
Cadmium			mg/l	1					<0.03
Copper			mg/l	1					<0.05
Iron			mg/l	1					<0.05
Lead			mg/l	1					<0.20
Magnesium			mg/l	1					17
Manganese			mg/l	1					<0.03
Nickel			mg/l	1					<0.10
Dissolved Solids			mg/l	1					468

Parameter	Discharge Licence Limits	Waste Licence Emission Limits (W4)	Units	V-Notch North	V-Notch North	V-Notch North	V-Notch North	V-Notch North	V-Notch North
				126727	126938	127094	127225	127597	127761
				21/01/2016	28/01/2016	04/02/2016	11/02/2016	26/02/2016	03/03/2016
Ammoniacal Nitrogen			mg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
BOD	5	5	mg/l	<2	<2	<2	<2	<2	<2
Orthophosphate as P		0.5	mg/l	<0.33	<0.33	<0.33	<0.33		<0.33
pH	6.0-9.0	6.0-9.0	pH Units	7.7	7.7	7.9	7.7	7.9	7.9
Suspended Solids	20	15	mg/l	5	21	34	37	15	17
Temperature oC	25	25	^{o}C	8	8	10	10	8	9
COD	30		mg/l					6	
Detergents as MBAS	10		mg/l					<0.05	
Dissolved Oxygen	6		mg/l					9.9	
Mineral Oil	10		mg/l					0.017	
Phosphate as P	1		mg/l					<0.33	
Sulphate	300		mg/l					254	
Ammonia as NH4	1	0.5	mg/l						
Zinc			mg/l						
Cadmium			mg/l						
Copper			mg/l						
Iron			mg/l						
Lead			mg/l						
Magnesium			mg/l						
Manganese			mg/l						
Nickel			mg/l						
Dissolved Solids			mg/l						

				V-Notch North	V-Notch North	V-Notch North
Parameter	Discharge Licence Limits	Waste Licence Emission Limits (W4)	Units	128188	128013	128392
				18/03/2016	10/03/2016	31/03/2016
Ammoniacal Nitrogen			mg/l	<0.08	<0.08	<0.08
BOD	5	5	mg/l	<2	<2	<2
Orthophosphate as P		0.5	mg/l	<0.33	<0.33	
pH	6.0-9.0	6.0-9.0	pH Units	8	7.8	7.9
Suspended Solids	20	15	mg/l	19.00	39	4
Temperature oC	25	25	^{o}C	7.00	10	8
COD	30		mg/l			4
Detergents as MBAS	10		mg/l			<0.05
Dissolved Oxygen	6		mg/l			9.4
Mineral Oil	10		mg/l			<0.010
Phosphate as P	1		mg/l			<0.33
Sulphate	300		mg/l			237
Ammonia as NH4	1	0.5	mg/l			
Zinc			mg/l			
Cadmium			mg/l			
Copper			mg/l			
Iron			mg/l			
Lead			mg/l			
Magnesium			mg/l			
Manganese			mg/l			
Nickel			mg/l			
Dissolved Solids			mg/l			

APPENDIX 6-E
SPILL KIT DETAILS

Safety Storage Systems Ltd.
- Spill Kit Details

Emergency Spill Response Kits designed to tackle chemical spills which occur outside bunded areas. Contents include Absorbent Socks, Mats, Pads, Instructions, Disposal Bags and PPE.

Supplied in highly visible mobile wheeled Bins.

Spill Kit type: General Purpos.

250 Litre Spill Kit
1 250 Litre Wheeled Bin
4 Socks (3m x 8cm)
20 Cushions
140 Pads (Double Weight)
1 Plug Rug (61cm X 40cm)
1 5Kg Plugging Granules
1 Caution Tape
4 Disposal Bags and Tie
1 Instruction Sheet