RECEIVING ENVIRONMENT REPORT

AIR ENVIRONMENT

Site Location and Surrounding Land Use

The proposed waste licence facility at Ballinclare quarry extends across all of the former quarry footprint and straddles two townlands, Ballinclare and Carrigmore, close to Kilbride, Co. Wicklow. The waste licence application area includes the former concrete / asphalt production area, a recently constructed paved concrete block yard, established site buildings and infrastructure and a network of settling ponds in the western apart of the site. It excludes a compound / yard area leased to Wicklow County Council in the north-western corner of the landholding. Permission for quarrying of rock at the quarry was previously granted under Planning Ref. 14/2118.

The area surrounding Ballinclare Quarry is typically rural in character and dominated by forestry and undulating agricultural land. Residential property in the vicinity of the application site generally comprises farmsteads and isolated / one off houses along the local road network. The nearest dwellings to the landholding boundary are those located to the south, west and north of the site, along the local county road network. There is another quarry located in Kilmacurra West, on the opposite side of the L1157 Local Road which is understood to be inactive at the current time. The Kilmacurragh Botanic Gardens are located just under 1km to the south-west of the site.

Potters River flows approximately 450m beyond the northern boundary of the application site and then turns south-eastwards and flows approximately 250m to the east of the landholding. Thereafter it continues south-eastward and eventually discharges to the sea at Brittas Bay.

There are no designated nature conservation sites (Special Area of Conservation (SAC), Special Protection Area (SPA), Natural Heritage Area (NHA) or proposed Natural Heritage area (pNHA) within or adjacent to the application site. Deputy's Pass Nature Reserve Special Area of Conservation (SAC, Site Code 000717) is located approximately 1.6km to the north-west of the application site, while Glenealy Woods proposed Natural Heritage Area (pNHA, Side Code 001756) is located approximately 1.0km to the north-west.

Details of natural features, established land-use and development surrounding the application site at Ballinclare Quarry are shown on Figure 7-1-3-2A.

Baseline Study Methodology

Baseline Dust Monitoring

Dust monitoring was undertaken at the application site by BHP Laboratories using the 'Bergerhoff method' referred to in the TA Luft Air Quality Standard in order to establish baseline emission levels relative to the prescribed 350mg/m^2/day emission limit.

The 'Bergerhoff' dust deposition gauge used in the survey comprises a plastic collection bottle with protective basket, mounted on a post and set at 1500mm above ground level. The input of atmospheric borne particular material into the collection bottle takes place over a pre-determined measurement period (usually one month) by exposing it to the environment. The total dust collected in the bottle is expressed as deposition of total particulate matter (mg/m^2/day) arising from human activity in the area surrounding the application site.

Sources of Information

A desk study undertaken to examine all relevant information relating to air quality conditions around the application site. Met Eireann, the National Meteorological Service, was consulted in relation to the climate / weather data in respect of the study area (http://www.met.ie). The EPA website was also accessed to obtain information on baseline air monitoring data around the application site (http://www.epa.ie/air/quality/data/).

Information published on its website by the National Parks and Wildlife Service (NPWS) (http://webgis.npws.ie/npwsviewer/), now part of the Department of Housing, Heritage and Local Government (DHHLG) in respect of designated ecological sites, protected habitats and species was also reviewed, together with Ordnance Survey Ireland (OSi) mapping and aerial photography (http://map.geohive.ie/mapviewer.html)

Field Survey / Monitoring

Dust deposition surveys were undertaken at and around the application site over the period April 2019 to November 2019. The dust deposition monitoring results recorded over this period are reviewed as part of this assessment. A survey of the extent of existing residential housing in the area of the proposed development was also undertaken.

The location of the dust deposition monitors at the application site are shown on Figure 7-1-3-2B:

- D1 – at northern boundary;
- D2 – at south west of the site;
- D3 – at south eastern boundary.

The results of the dust deposition monitoring are presented in Table 7-1-3-2A below.

Table 7-1-3-2A
Baseline Dust Deposition at Ballinclare

DATE	DUST DEPOSITION		
	D1 (mg/m^2/day)	D2 (mg/m^2/day)	D3 (mg/m2/day)
02/04/2019 - 07/05/2019	112	332	89
07/05/2019 – 10/06/2019	58	209	100
10/06/2019 – 04/07/2019	168	201	79
04/07/2019 - 07/08/2019	61	13	22
07/08/2019 – 04/09/2019	116	143	65
04/09/2019 – 03/10/2019	107	144	24
03/10/2019 - 04/11/2019	276	328	314

As it will be noted, the recorded baseline dust deposition rates at Ballinclare over the recent monitoring period are below the guideline emission limit value (ELV's) of 350mg/m^2/day.

Background Air Quality

The application site at Ballinclare Quarry lies in air quality Zone D-rural east. The closest air quality monitoring locations to the site, and in a similar rural setting (Zone D) is located at Kilkitt, Co. Monaghan. The EPA monitoring stations continuously monitor concentrations of particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}). Recent annual mean concentrations monitored at Kilkitt (published on the EPA website[1]) are presented in Table 7-1-3-2B below.

Table 7-1-3-2B
Background PM_{10} Concentrations

YEAR	ANNUAL MEAN (µg/m³)	NUMBER OF DAYS >50µg/m³
2013	11	3
2014	9	2
2015	9	1
2016	8.1	0
2017	7.8	0
2018	9	0
2019	7	1

Table 7-1-3-2B indicates that representative PM_{10} concentrations monitored at the Kilkitt monitoring site are below the annual mean Air Quality Standards (AQS) of 40µg/m³ and comply with the requirement that a 24-hour mean of 50µg/m³ should not be exceeded more than 35 times in a calendar year.

For rural areas, such as those surrounding the application site, the primary source of PM_{10} would be residential solid fuel emissions and local agricultural or rural based activities for deposited dust.

Meteorology

Dispersion of Emissions

The most important climatological parameters governing the atmospheric dispersion of particles are as follows:

- wind direction determines the broad transport of the emission and the sector of the compass into which the emission is dispersed; and
- wind speed will affect ground level emissions by increasing the initial dilution of particles in the emission. It will also affect the potential for dust entrainment.

Rainfall is also an important climatological parameter in the generation of dust; sufficient amounts of rainfall can suppress dust at the source and eliminate the pathway to the receptor. According to Arup (1995)[2] rainfall, greater than 0.2mm per day is sufficient to suppress dust emissions.

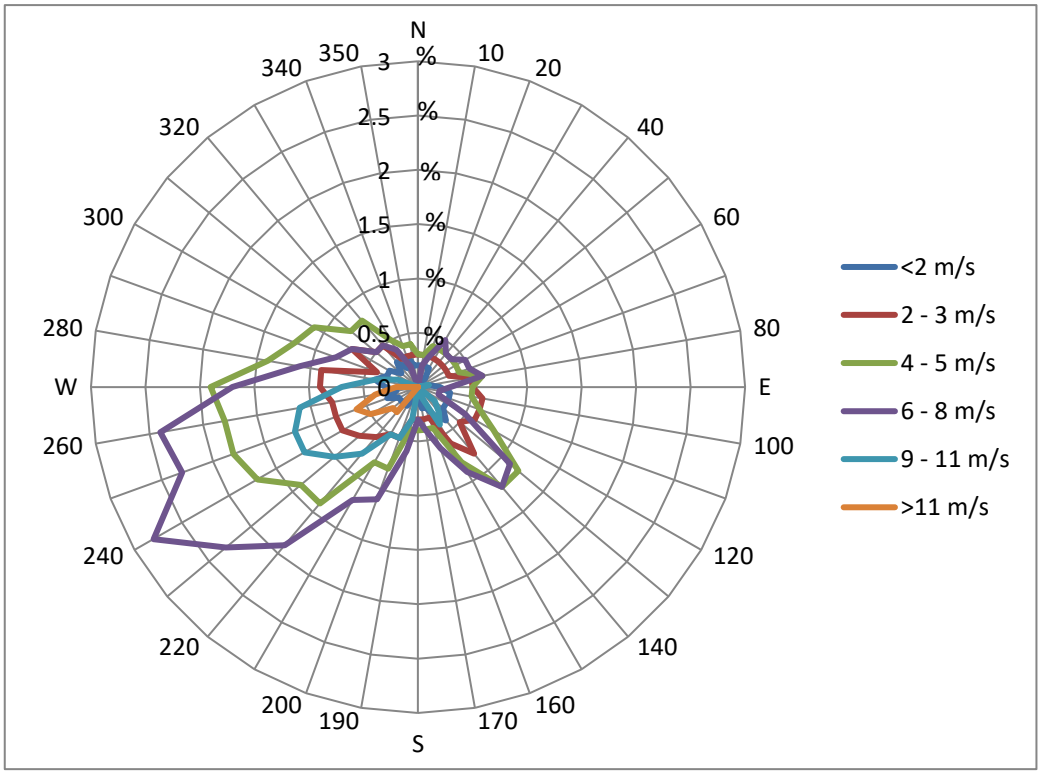
[1] Secure Archive for Environmental Research Data – http://erc.epa.ie/safer/.

[2] Arup Environmental, Ove Arup and Partners (1995) The Environmental Effects of Dust from Surface Mineral Workings, HMSO, London (ISBM 11 75 3186 3)

Local Wind Speed and Direction Data

The closest weather station with sufficient records of wind direction and wind speed likely to be representative of conditions experienced at the application site is at Baldonnell (Casement) Aerodrome Meteorological Station, located approximately 45km to the north-west.

A windrose for the average conditions recorded at Baldonnell (Casement) Aerodrome over the ten-year period 2007-2016 is presented below. The predominant wind direction is from the south-western quadrant. Moderate to high-speed winds (>2 m/s) occur for approximately 82.6% of the time.



Rainfall Data

Relevant rainfall data applicable to the overall site has been obtained from the Irish Meteorological Service website for the Baldonnell (Casement) Aerodrome station (2007–2016). The annual average days with rainfall greater than 0.2mm is 186 days per year. Natural dust suppression (from rainfall) is therefore considered to be effective for 51% of the year.

NOISE ENVIRONMENT

Sources of Information

Baseline information was gathered through a combination of desk-based study, site visit, and technical assessments consistent with current standard methodologies and published best practice guidelines. This provided relevant data to allow an assessment of likely significant effects of the proposed development on sensitive receptors within its zone of influence.

Baseline Study Methodology

Environmental noise surveys were carried out to capture typical background noise levels at the noise-sensitive receptors closest to the application site. The methodology of the surveys and the results are set out below. The weather conditions during the survey periods were acceptable for noise monitoring, being generally dry with little or no wind.

The measurements were carried out using a Larson Davis 812 Type 1 sound level meter. The sound level meter was calibrated before the measurements, and its calibration checked after, using a field calibrator. No calibration drifts were found to have occurred during surveys. All noise equipment had been calibrated to a traceable standard by UKAS (United Kingdom Accreditation Service) accredited laboratories within 24 months preceding the surveys.

At the measurement positions, the following noise level indices were recorded:

- $L_{Aeq, T}$ is the A-weighted equivalent continuous noise level over the measurement period (T), and effectively represents an "average" value.
- $L_{A90, T}$ is the A-weighted noise level exceeded for 90% of the measurement period (T). This parameter is often used to describe the background noise.
- $L_{A10, T}$ is the A-weighted noise level exceeded for 10% of the measurement period (T). This parameter is often used to describe traffic noise.

All noise levels are recorded in 'A-weighted' decibels, dB(A). 'A-weighting' is the process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted in dB(A) relative to a sound pressure of 20µPa.

Environmental noise surveys were undertaken by BHP Laboratories at the nearest noise sensitive receptors to the application site on 23rd April 2019. Monthly noise measurements were undertaken at each location over a 30-minute period during daytime hours (07:00 to 19:00) each month between April and October 2019.

During the surveys, the sound level meter was located in free-field conditions (i.e. at least 3.5m from the nearest vertical reflecting surface, with the microphone approximately 1.5m above ground level).

Field Survey / Monitoring

The noise monitoring locations used for the purposes of the baseline noise survey, shown in Figure 7-1-3-2B, comprise the following :

- N1 at the north-western corner of the site;
- N2 at the south-eastern corner of the site;
- N3 to the south-western corner of the site.

The baseline noise monitoring locations listed above are considered representative of the nearest noise sensitive locations (receptors) to the application site, as described below:

- Location N1 is considered representative of residential properties located to the north of application site.
- Location N2 is considered representative of residential properties to the south-east of the application site.
- Location N3 is considered representative of the residential properties located to the south west of the application site.

Noise monitoring results for the monthly baseline survey are provided in Table 7-1-3-2C. Logarithmic average L_{Aeq} values are provided in Table 7-1-3-2D.

Table 7-1-3-2C
Summary of Measured Noise Levels, Free Field dB

LOCATION	DATE	TIME	$L_{Aeq,T}$	L_{A90}	L_{A10}
N1	23/04/2019	12:52	43	38	46
N1	28/05/2019	13:58	41	27	43
N1	10/06/2019	18:02	45	36	49
N1	04/07/2019	09:50	40	29	44
N1	07/08/2019	09:32	45	36	48
N1	04/09/2019	11:52	45	36	48
N1	3/10/2019	10:05	53	43	57
N2	23/04/2019	13:32	44	38	47
N2	28/05/2019	14:37	50	41	51
N2	10/06/2019	18:41	42	38	45
N2	04/07/2019	10:00	41	34	41
N2	07/08/2019	09:10	44	38	45
N2	04/09/2019	11:21	44	38	45
N2	3/10/2019	10:08	54	48	56
N3	23/04/2019	13:05	43	38	46
N3	28/05/2019	14:03	39	28	43
N3	10/06/2019	17:44	43	37	49
N3	04/07/2019	10:26	39	28	40
N3	07/08/2019	09:44	44	37	49
N3	04/09/2019	11:55	45	37	49
N3	3/10/2019	10:12	51	48	55

Table 7-1-3-2D
Summary of Measured Noise Levels (Averaged)

LOCATION	RECEPTORS	PERIOD	$L_{AEQ\ AVGE}$
N1	R7 to R11	Daytime	46
N2	R12, R13	Daytime	48
N3	R1 to R6	Daytime	45

WATER ENVIRONMENT

Methodology

The methodology used to establish / investigate the waste environment around Ballinclare Quarry followed the guidelines and advice notes provided by the Environmental Protection Agency (EPA) on environmental impact assessments, with due regard also to Institute of Geologists of Ireland's (IGI) guidelines (2013).

The methodology involved in the assessment of the hydrogeology and hydrology baseline at the application site can be summarised as follows:

- Review of existing reports, EIAR and site investigation data (groundwater monitoring wells and boreholes);
- A desk study in which available site-specific data and relevant regional data sources for the wider area were examined;
- Site visits in which the aspects of the sites hydrology and hydrogeology were assessed;
- Sampling of groundwater and water from the site; and
- Analysis of the information gathered.

Sources of Information

The existing reports and EIA reports reviewed for the purposes of this assessment are :

- Hydrological and Hydrogeological Assessment for Proposed Quarry Extension at Ballinclare, Co Wicklow, report reference CE04177, White Young Green, 2007; and
- Environmental Impact Statement, Ballinclare and Carrigmore Townlands, December 2006.

The desk study involved the examination of several datasets to determine the geological and hydrogeological setting of the area, as detailed in Table 7-1-3-2E-.

Table 7-1-3-2E
Regional Data Consultation

Data	Dataset	Data Type/ Scale
Subsoil Geology	Teagasc Database	Digital
Soil Geology	GSI Bedrock Geology Sheet 16	1:100,000
	GSI Groundwater Data Viewer – Teagasc Soils	Digital
Surface Water	OSi Discovery mapping, Environmental Protection Agency, and Water Framework Directive mapping. OPW flood risk, and PFRA mapping.	Digital
Groundwater	GSI bedrock and gravel aquifer maps Groundwater body description documents Environmental Protection Agency and Water Framework Directive mapping	1:100,000 Digital
Elevation	OSi Discovery Series Mapping	1:50,000

Data	Dataset	Data Type/ Scale
Climate	Met Eireann	Digital
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service	Digital

A site visit and inspection of the application site was originally undertaken by an SLR hydrogeologist on 1st September 2014. During that site visit, the water supply well was identified, existing surface water management activities at the site established and the hydrological and hydrogeological environment confirmed. There was no significant groundwater inflow noted at the time of the site visit. Further site visits were undertaken by SLR staff in 2019 for the purposes of this assessment.

Surface Water - Hydrology

Ballinclare Quarry lies entirely within the Water Framework Directive (WFD) Ovoca-Vartry Catchment and the Redcross Sub-Catchment. At the EPA Sub-Basin level, the quarry is within the Potters River catchment.

Potters River is located to the north and east of the application site. It flows in an easterly direction initially and then turns to flow in a south-easterly direction. It is located c. 300m from the site at its closest point. The Kilmacurra Stream is located c. 200m to the south of the application site and flows in an easterly direction, to its confluence with the Potters River.

The Irish Sea is c. 7.5km east of the application site. The coastal area of the Irish sea east of the site is designated a Special Area of Conservation (SAC) for species and habitat.

Surface Water Abstractions

Water flowing in the Potters River is not abstracted for drinking water or recreational use (refer to www.catchments.ie). No surface water abstractions from Potters River are recorded in the vicinity of the application site on the EPA abstraction register (www.epa.ie).

Surface Water Discharges

Since extraction and production activities ceased in 2016, the excavated void at Ballinclare Quarry has been flooded with surface water run-off and groundwater ingress and water levels have risen to cover the quarry floor. The current discharge licence issued by Wicklow County Council in respect of the existing quarry development (Ref. WPL 116, dated 1 November 2019) provides for the ongoing off-site discharge of any water collecting in the quarry void to the Ballinclare Stream (and Potters River further downstream).

The discharge licence requires water pumped from the existing sump (using a rising main pipe) to be passed through an approved treatment system located at the former storage area. The treatment system comprises a bespoke Siltbuster treatment unit required to treat naturally elevated levels of arsenic in the water collecting in the quarry void. As well as reducing arsenic concentrations, the unit also removes suspended solids from the water.

Following treatment, surface water run-off flows under gravity towards the existing network of settlement lagoons for further polishing and sediment removal. The settlement lagoons provide approximately 16 hours retention time which is generally considered sufficient, as the treatment plant removes the majority of suspended solids in the discharge waters.

Discharge emission limit values are set out in Table 1 of the licence. An impact assessment of the discharge from the quarry on the Potters River undertaken in support of the discharge licence application comprised an assessment of the Assimilative Capacity (AC) in the river and a calculation of the Mass Balance (MB) for the river with discharge from the quarry in place.

The only other Section 4 Discharge Licence for discharge to the Potters River is for the Tap Pub (Ref. No. WPL-96) at Kilbride which lies approximately 2.7km downstream of Ballinclare Quarry.

Surface Water Quality

The overall status of the Potters River and Kilmacurra Stream is moderate according to the EPA River Waterbody WFD Status Report for 2010-2015. Surface water quality in the Potters River is monitored at Kilboy bridge, approximately 1.5km south-east of the application site. The Q value is 3-4, indicating a moderate water quality, and was last measured in 2015.

Inland Fisheries Ireland notes that 2018 EPA biological monitoring recorded Q values 3-4 at EPA Site 0300 at Kilboy Bridge downstream of the quarry and also commented "the macroinvertebrate fauna continues to indicate unsatisfactory ecological conditions at Kilboy Bridge".

The rivers passed acidification, dissolved oxygen saturation, general conditions, nutrient conditions, oxygenation conditions, pH, and supporting chemistry conditions. The rivers were classed as moderate in biological status and invertebrate status, and in terms of nitrates. They were classed as high in other oxygenation conditions.

Inland Fisheries Ireland notes that the Potters River and catchment is a very important salmonid system supporting Atlantic salmon (*Salmo salar* listed under Annex II and V of the EU Habitats Directive), Lamprey (Annex II) and Sea trout (*Salmo trutta*), in addition to resident Brown trout. Potters River is not designated as a Salmonid River, however as part of a previous planning application at the quarry WYG undertook consultation with the Eastern Regional Fisheries Board and it was reported that downstream of the quarry site is an important spawning ground for salmon and trout.

WYG took surface water samples in May 2007, from a drain upstream of the quarry entrance (SW1), at its confluence with Potters River downstream of the quarry (SW2), and from a containment pond at the quarry entrance (SW3). These samples were analysed for major anions, cations and suspended solids. All surface water samples were found to comply with the EPA Interim Guideline Values, with the exception of potassium in SW3. The water sample from the settlement pond showed the highest value for conductivity, alkalinity, sulphate, and calcium of all the samples but these levels are still within the recommended limits and are probably a result of concentration due to evaporation.

The overall status of the coastal Irish Sea directly east of the quarry is high according to the EPA Coastal Waterbody WFD Status 2010-2015. It was classed as high in biological status, invertebrate status, phytoplankton status, dissolved oxygen saturation, oxygenation conditions, other oxygenation conditions, general conditions, nutrient conditions, other nutrient conditions, and supporting chemistry conditions. The Coastal Water Quality 2010-2012 is unpolluted. It is not at risk of deterioration.

The overall status of the coastal Irish Sea south-east of the application site, where the Potters River discharges into the sea, is unassigned according to the WFD Status 2010-2015. The Coastal Water Quality (2010-2012) is classified as being unpolluted.

Surface water samples were taken from three surface water locations (SW1, SW3B and SW4) and the existing sump at Ballinclare Quarry on two locations in March 2019. As can be seen in Figure 7-1-3-2C, sample location SW1 is on the small stream which runs past the quarry, into which off-site discharges flow. Location SW3B is located on the Potters River upstream of the application site and location SW4 is at the bridge downstream of it. Results of water testing on collected samples are presented in Table 7-1-3-2F below

Table 7-1-3-2F
Surface Water Quality

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Ammonia (Surface Water)	mg/L as N	0.02	0.02	0.01	0.01	0.11	0.81	0.12	0.05				0.065-0.175	0.30
Arsenic (Dissolved)	ug/L	<1.0	<1.0	<1.0	591.1	1.0	<1.0	<1.0	522.8	25 (AA)	20 (AA)	10	7.5	10
Asbestos Identification*	N/A	-	-	-	-	-	-	-	-					
BOD (Surface Water) (River)	mg/L	1.2	1.6	1.1	1.1	2	4	4	3	"High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)"				
Cadmium (Dissolved)	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09			5		5
Chloride (Surface Water)	mg/L	21.7	18.9	19.8	17.6	19.9	18.1	17.9	17.2	0.45 - 1.5	0.45 - 1.5	30	24-187.5	250
Chromium (Surface Water)	ug/L	3	2	2	3	1	<1	<1	1			30	37.5	50
COD (Surface Water)	mg/L	17	14	15	19	47	5	<5	7	32				

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Conductivity (Surface Water at 20°C)	µS/cm @ 20°C	178.0	191.0	163.0	364.0	167.2	185.7	152.1	364.0			1000	800 - 1875*	2500
Copper (Dissolved)	ug/L	2	2	1	3	1	2	<0.142	2			30		2000
Dissolved Oxygen (mg/l)	mg/L	10.3	10.3	10.3	10.6	11.0	10.7	11	11.2	5 or 30 (AA)	5 (AA)			
Hardness Total (Surface Water)	mg/L CaCO3	57	72	49	131	56	64	46	129			200		
Lead (Dissolved)	ug/L	0.4	0.2	0.3	<0.173	0.3	0.3	1.4	0.2			10	7.5	10
Mercury (Dissolved)	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	7.2 (AA)	7.2 (AA)	1	0.75	1
Nickel (Dissolved)	ug/L	3	3	4	5	<0.374	2	1	3	0.07	0.07	20		20
Nitrate (Surface Water)	mg/L as N	3.38	5.60	4.04	<0.51	4.17	6.64	4.44	<0.51	20 (AA)	20 (AA)	25	37.5	50
Nitrite (Surface Water)	mg/L as N	<0.01	<0.01	<0.01	<0.01	0.02	0.02	0.01	0.01			0.1	0.375	0.5
pH (Surface Water)	pH Units	7.46	7.41	7.38	8.16	7.51	7.55	7.36	8.22			6.5 - 9.5		6.5 - 9.5
Phosphate (Ortho) Surface Water	mg/L as P	<0.014	<0.014	<0.014	0.060	0.059	0.374	0.036	0.047			0.03		

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
PRO (>C6-C12)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5					
Solids (Total Suspended)	mg/L	<2	<2	<2	<2	<2	<2	<2	<2					
Sulphate (Surface Water)	mg/L	11	16	10	73	10	12	10	69			200	187.5	250
Zinc (Surface Water)	ug/L	18	20	18	19	51	27	26	9			100	75	

Environmental Quality Standard (EQS) green: SI 272 of 2009

Environmental Quality Standard (EQS) blue: SI 327 of 2012

The water quality results from sample locations SW1, SW3B and SW4 were compared against quality thresholds set out in the Surface Water Regulations (SI 272 of 2009 and SI 327 of 2012). The results from the quarry sump were also compared against the Surface Water Regulations as well as the EPA Interim Guideline Values (EPA IGVs), Groundwater Regulations SI 9 of 2010 (GW Regs) and Drinking Water Regulations (SI 278 of 2007, DW Regs). The following exceedances were noted:

- At SW1, zinc concentrations exceed threshold values in SW SI 272 of 2009 EQS Other Surface Waters (MACs) on 26/03/19.
- At SW3B, BOD is neither high nor good quality on the 26/03/19, based on SI 272 of 2009
- At SW4, BOD is neither high nor good quality on the 26/03/19, based on SI 272 of 2009
- The recorded concentrations at the quarry sump exceeds all assessment criteria for arsenic on both sampling dates; exceeds EPA IGV criteria for orthophosphate on both dates; exceeds EPA IGV criteria for potassium on the 05/03/19 (not tested for on 26/03/19); exceeds Drinking Water limits for antimony on the 05/03/19 (not tested for on 26/03/19) and BOD is neither high nor good quality on 26/03/19, based on limits in SI 272 of 2009.

An asbestos identification was carried out on the surface water and quarry sump samples, and no asbestos was reported.

Surface Water Flows

To support implementation of the Water Framework Directive, the EPA has developed a catchment-based model for the calculation of flow duration curves for ungauged catchments[3]. For Potters River in the vicinity of Ballinclare Quarry, the catchment area is estimated at c. 23.8km^2, with an average annual rainfall of c. 1,053mm/yr. (1960-1991). The flow duration report for the Potters River estimates the 5th%ile flow at c. 1.685m^3/s and the 95th%ile lower flow is estimated at 0.057m^3/s.

There are no flow monitoring stations on the Potters River in the vicinity of the application site. The closest catchment with a flow monitoring station is on the Avonmore River over 6km west of the site. Flow and water levels in the Avonmore River would not be representative of the Potters and Kilmacurra Stream.

Flooding

The Office of Public Works (OPW) is the government agency with statutory responsibility for flooding in Ireland. The OPW website (www.floodmaps.ie) indicates that there are no recorded flood events in the vicinity of the application site from the Potters River.

The Preliminary Flood Risk Assessment (PFRA) maps prepared by the OPW under the Floods Directive (2007/60/EC) indicate areas of potential flooding identified from mapping / modelling exercises. PFRA Map Reference 2019/MAP/188/A covers the area around Ballinclare Quarry and indicates no flooding potential associated with the Potters River. However, some areas with an indicative pluvial 1%AEP (100 year) event (associated with overland flow and ponding) are noted to occur locally in the vicinity along the Potters River.

There are no benefiting lands from flood protection works along the Potters River at the application site (www.floodmaps.ie). Benefiting lands is a dataset prepared by the OPW identifying land that benefited from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and identifies areas of land which were previously subject to flooding or poor drainage.

[3] http: // watermaps.wfdireland.ie /HydroTool/

Water Management

Currently, rainfall across the application site infiltrates naturally to the ground and recharges the underlying groundwater with diffuse recharge. During storm events surface water run-off across most of the site will drain to the quarry void, while some runoff from the western end of the site will go to the discharge drain at the western boundary of the site.

The existing quarry void is currently flooded with surface water run-off and groundwater. The water in the quarry is currently being discharged off site to the Potters River under a discharge licence.

When operational, the quarry was effectively worked dry with very little inflow of groundwater reported within the void. A quarry sump located at the lowest level on the quarry floor collected any surface water falling over the void area and any minor inflows of groundwater which occurred. This water was recycled and used in concrete production activities and on-site dust suppression, with periodic pumping of water to on-site storage tanks as required.

Groundwater – Hydrogeology

The application site at Ballinclare Quarry is underlain by diorite bedrock, identified as the Carrigmore Diorite. The bedrock outcrops at the surface or is overlain by a thin cover of glacial till. The diorite bedrock has been proven to 40m below the existing quarry floor level (to below 0mOD).

Bedrock aquifer maps published on the GSI website provide a detailed classification of bedrock aquifer types and indicate that the diorite bedrock is classified as a poor aquifer (Pl) which is generally unproductive except in local zones.

The closest classified sand and gravel aquifer is a locally important aquifer, located approximately 9km to the north of the application site and not connected to it.

Groundwater Body

Ballinclare Quarry is located within the Wicklow Groundwater Body (GWB). Initial characterisations of GWBs have been developed by the GSI and augmented by the River Basin District (RBD) consultants. A summary of the GSI groundwater body descriptions is provided below.

The groundwater at the application site is of good status according to the EPA Groundwater Body WFD Status Report for 2010-2015. The overall objective is to protect the water body and the groundwater body overall risk is described as "*Possibly at risk of not achieving good status*".

The Wicklow GWB covers an area of 1,396km^2 and is described as being as generally poorly productive aquifer, being composed primarily of low permeability rocks. There are large areas of the GWB where the rock is close to surface, which would suggest high potential recharge values, but recharge calculations also consider the effect of rejected recharge from the lower permeability rocks. The aquifers within the GWB are generally unconfined.

The majority of groundwater flow is reported to occur in the upper 3m of the bedrock. This flow is mostly along a weathered zone in the bedrock, with flow in a lateral direction towards rivers and springs. As well as discharging to overlying streams and rivers as baseflow, groundwater flow also discharges directly to the sea along the coast.

In some instances, a greater degree of structural deformation may provide a fracture network which will allow groundwater movement at greater depth. Deep-water strikes are often encountered (between 10m and 40m bgl), but these are more isolated features along open fractures which allow groundwater flow. Only flow in isolated fractures is expected to occur below 30m depth (bgl).

Regional groundwater flow paths are not considered to develop as the rocks do not have sufficient transmissivity to transport water over long distances. Typical groundwater flow paths are reported to be of the order of a couple of hundred metres, with discharge occurring to the closest surface water feature.

The dominant recharge process within the GWB is diffuse recharge from water percolating through the overlying tills and into the aquifer. Although high rates of potential recharge would be expected in areas where there are very thin subsoils, a large portion of the potential recharge in the area is rejected because the rock formations are considered to be poor aquifers with low storativity. In addition, the steep slopes across the GWB area also give rise to increased surface water run-off.

The hydrochemical groundwater signature is a calcium bicarbonate type and is soft to moderately hard (50–250 mg/l CaCO3). Low conductivity values are recorded at 130 – 220 µg/l.

Groundwater Vulnerability

The GSI has developed a groundwater vulnerability classification for Ireland. The groundwater vulnerability at a particular point can be determined based on the natural geological and hydrogeological characteristics at that location. The groundwater vulnerability depends on the nature of the subsoils (i.e. their permeability characteristics), the type of recharge (point or diffuse) and the thickness of the unsaturated zone (depth to groundwater).

GSI mapping indicates that the aquifer at the application site has a vulnerability rating of E (Extreme) or X (rock at or near the surface, or karst). The GSI vulnerability rating table indicates that this rating arises as there is less than 3m of subsoil present at the site.

As soil and subsoil has been removed across the quarry footprint, there is no protective soil cover and therefore the groundwater vulnerability is rated as X (Rock at Surface) or E (Extreme). When the quarry is completely backfilled at some point in the future, the groundwater vulnerability across the quarry footprint will be reduced to Low (L) as the combined thickness of the low permeability liner, inert soil/ stone waste material and restoration surface will be >10m in thickness.

The application site is reported to have very low to low sub-surface and low to very high near surface nitrate susceptibility. It also is reported as having low to moderate near surface phosphate susceptibility (EPA, www.catchments.ie).

Groundwater Recharge

The main hydrogeological controls on groundwater recharge include the permeability and thickness of superficial deposits (mainly glacial tills), the presence of saturated soils, and the ability of the underlying aquifer to accept percolating waters. Combinations of these factors are assessed, and a 'recharge coefficient' is established for different hydrogeological scenarios.

The dominant recharge process is typically diffuse recharge from rainfall / water percolating through the overlying soils and subsoils, where present, and into the aquifer. High rates of potential recharge are usually expected in areas where there are very thin subsoils.

However at Ballinclare, a large portion of potential recharge is rejected because the rocks in the area are considered to be poor aquifers with low storativity and most potential recharge will therefore run-off overground to surface water features. Mapping published by the GSI indicates that the maximum recharge capacity for the area surrounding Ballinclare Quarry is 100mm/yr.

Groundwater Abstraction and Wells

A water supply well is located at the western boundary of the application site, shown in Figure 7-1-3-2C. The water from this well supplies the existing wheelwash and provides a top-up supply for concrete production, dust suppression and toilet flushing as required. It is not used as a potable supply. The

pumping well is located adjacent to a pump house and is approximately 28cm diameter. The water level in the pumping borehole was recorded at 3.25m bgl on 1st September 2014.

The GSI national well database (www.gsi.ie) identifies a number of wells in the immediate vicinity of the application site (<1km). Well locations are shown on Figure 7-1-3-2C.

- Borehole number 3217NWW139 is located to the north west of the site and was drilled in 1967 to a depth of 25.6m. Reported depth to rock is 4m. The borehole is for domestic use only and reported a poor yield 27m^3/d;
- Borehole number 3217NWW126 is located to the south east of the site and was drilled in 1973 to a depth of 30.5m. The borehole is for domestic use only and the yield was reported as poor; and
- Borehole number 3217NWW103 was drilled in 1996 to a depth of 91.4m, with a yield class of poor reported at 20m^3/d.

WYG undertook a well survey in the vicinity of Ballinclare Quarry in June 2005 and identified four domestic wells which supplied three houses. The water levels were recorded where possible, to establish baseline conditions. It was not possible to use the data to produce a groundwater contour map because the levels in the wells fluctuate depending on use. The results of the survey are presented in Table 7-1-2-3G below.

Table 7-1-3-2G
White Young Green Well Survey 2005

Well number	Location	Owner	Depth (m)	Water level (m bgl)	Diameter (mm)	Comments
PW1	Ballinclare	Ballinclare Quarry	60	6	150	Potable water supply to existing quarry
PW2	Ballinclare extension		120	-	150	Groundwater ingress <10m bgl. Standby process and dust suppression
PW2a	Ballinclare extension		122	-	150	Added in 2007, standby process and dust suppression
PW3	Ballinclare quarry		152	Artesian	150	Added in 2007, abandoned
DWA	Kilmacurra West	George Lawless	51.8	2.9	150	Steel casing, no PVC
DWB	Carrigmore	Dieter Clissman	122	1.1	150	Steel casing, no PVC
DWC	Carrigmore	Mrs Olstoff	30	1.45	150	Steel casing, no PVC
DWD	Carrigmore	Mrs Olstoff	4	2.85	1000	Gravity fed dug well
DWE	Carrigmore	John Kinsella	-	-	-	-

It is understood that there is no mains water supply or group water scheme in the area, and that dwellings in the area each have individual private groundwater wells. The closest domestic dwelling at Knockanereagh to the south of the quarry, is approximately 220m from the quarry void.

The application site is not located within a public supply source protection area. The closest source protection area is that for the Redcross Public Water Supply (PWS), located approximately 5km south of the quarry.

It is envisaged that an updated well survey will be undertaken to identify groundwater wells within 2km of the application site prior to commencement of any on-site activities. A number of downgradient wells will be selected for monitoring and will have groundwater quality sampling undertaken prior to commencement of inert / C&D waste intake and at least biannually during the subsequent construction and operational phases.

As previously noted, there are currently three on-site groundwater monitoring boreholes on site at Ballinclare Quarry (GW1, GW2, GW3).

Groundwater Levels

Various boreholes have been drilled around the quarry / application site. Groundwater levels have been monitored in these boreholes in the past and the results are presented in Table 7-1-3-2H below.

Table 7-1-3-2H
Groundwater Levels in GW and BH (mOD)

Borehole	Depth (m)	10/10/14	16/10/14	04/11/14	26/03/19	02/04/19
GW1	68	54.895	55.99	56.040	58.04	57.43
GW2	61	51.144	-	50.769	50.80	50.85
GW3	75	c. 47	54.196	54.096	53.14	54.08
BH1	40	37.892	37.842	37.892	-	-

The groundwater levels show highly localised variations and do not indicate a particular groundwater flow direction across the application site. However, localised groundwater flow in the area is presumed to be towards the Potters River, to the south and east of the site, with regional groundwater flow towards the coast to the east.

Topographically, the catchment area is small. It is likely that rain falling within the catchment runs-off rapidly rather than recharging through the almost impermeable bedrock and so reaches the application site in the form of surface water rather than groundwater. Any groundwater flowing through the upper (fractured) bedrock will eventually discharge into Potters River.

Groundwater Quality

Groundwater samples were taken from the three existing monitoring wells boreholes (GW1, GW 2 and GW3) once a month from May to November 2019 (seven samples in total from each monitoring well).

The groundwater results were compared with the following assessment criteria, in the order listed below:

- European Communities Environmental Objectives (Groundwater) Regulations, 2016. S.I. No 3669 of 2016;
- European Communities (Drinking Water) Regulations 2014 Quality. S.I. No 122 of 2014; and
- EPA Interim Report *Towards Setting Guideline Values for the Protection of Groundwater in Ireland.*

Where assessment criteria are available for a particular quality parameter / contaminant, the threshold limits set by the EC Environmental Objectives Regulations 2016 are taken to supersede EPA IGVs.

Average, minimum, and maximum results are presented in Table 7-1-3-2I and indicate the baseline groundwater quality. PAHs and hydrocarbons were also scheduled for analysis for completeness.

The groundwater quality testing identified the following exceedances:

- Ammonia is elevated above assessment criteria in GW1 in November 2019 only. This is likely to be as a result of agricultural practices in the area.
- Orthophosphate is elevated above the assessment criteria in all three boreholes during every sampling round, again this is likely to be as a result of agricultural practices in the area.
- Total coliforms is elevated above assessment criteria in all three boreholes during every sampling round.
- Potassium was only sampled in May 2019; concentrations were elevated in GW1 and GW3.
- Arsenic is elevated in all three boreholes during the majority of sampling rounds. Arsenic is not used on site and again is expected to be naturally occurring, with soil concentrations of 31.47mg/kg recorded by the EPA. The Soil Geochemical Atlas of Ireland shows the wider area to have arsenic in the area at >15mg/kg.
- Iron is elevated in all three boreholes during the majority of sampling rounds.
- Mercury is elevated at all three boreholes during the sampling round in August 2019, but not in another other sampling round in 2019.
- Manganese was only sampled in May 2019; the concentration was elevated in borehole GW3 only. This is likely to be naturally occurring and the EPA Soils Database records 2147 mg/kg for a soil sample to the south of the site (ID 138). The Soil Geochemical Atlas of Ireland shows the wider area to have manganese in the area at >1400mg/kg.
- Nickel is elevated in GW1 in September and GW2 in October 2019.
- Lead was elevated in GW2 and GW3 in June and July 2019. From August to November 2019, the limit of detection was above the assessment criteria.

Hydrocarbons were below detection limit in all three boreholes during every sampling round. PAHs were tested for in May 2019 and all were below detection limit in all three boreholes. It is noted that the water pumped from the production borehole is not used for potable supply and that bottled drinking water is brought onto the site for consumption as required.

Local Wastewater Treatment

There is no local mains sewer serving residential properties in the local area around the application site at Ballinclare Quarry. Local residences have individual wastewater treatment systems comprising either a basic septic tank with adjacent percolation area or a packaged wastewater treatment system.

Table 7-1-3-2I
Groundwater Quality Results 2019

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Conductivity (25°C)	µS/cm	452.67	567	321	368.50	424	345	534.67	599	273
pH	pH units	7.76	7.98	7.56	7.18	7.91	6.9	8.02	8.1	7.9
Total Ammonia (as N)	mg/l	0.12	0.2	0.1	0.10	0.11	0.1	0.10	0.11	0.1
Ammoniacal Nitrogen (NH3-N)	mg/l	0.1	0.1	0.1	0.1	0.1	0.1	0.11	0.11	0.11
Chloride (as Cl-)	mg/l	11	11	11	21	21	21	63	63	63
Sulphate (as SO42-)	mg/l	15	15	15	10	10	10	10	10	10
Fluoride (as Fl-)	mg/l	0.13	0.13	0.13	0.43	0.43	0.43	0.17	0.17	0.17
Nitrate (as NO3)	mg/l	1.15	3.1	0.5	1.65	3.1	0.55	0.69	0.95	0.5
Nitrite (as NO2)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Orthophosphate (as PO4)	mg/l	0.13	0.46	0.065	0.11	0.41	0.065	0.17	0.65	0.065
Total coliforms	MPN/100ml	1269.14	>2420	55	1418.86	>2420	51	1456.43	>2420	4
E coli	MPN/100ml	10	19	1	102	613	1	4	6	2
Cyanide (total)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Cyanide (free)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sulphide	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium	mg/l	9.1	9.1	9.1	120	120	120	49	49	49
Total Calcium	mg/l	34	34	34	14	14	14	140	140	140
Total Potassium	mg/l	26	26	26	3.1	3.1	3.1	5.8	5.8	5.8
Total Magnesium	mg/l	6.2	6.2	6.2	2.1	2.1	2.1	4	4	4
Aluminium (total)	mg/l	0.07	0.07	0.07	0.017	0.017	0.017	0.03	0.03	0.03
Arsenic (total)	mg/l	0.044	0.13	0.0043	0.022	0.12	0.0033	0.123	0.16	0.089
Boron (total	mg/l	0.026	0.026	0.026	0.44	0.44	0.44	0.046	0.046	0.046
Barium (total)	mg/l	0.033	0.033	0.033	0.027	0.027	0.027	0.0084	0.0084	0.0084
Cadmium (total)	mg/l	0.003	0.005	0.00008	0.003	0.005	0.00008	0.003	0.005	0.00008
Chromium (total)	mg/l	0.004	0.01	0.001	0.004	0.008	0.001	0.003	0.005	0.001
Copper (total)	mg/l	0.015	0.025	0.001	0.015	0.025	0.001	0.015	0.025	0.001
Iron (total)	mg/l	0.69	2	0.24	0.77	2.7	0.14	0.69	1.3	0.18
Mercury (total)	mg/l	0.001	0.00075	0.0005	0.001	0.0013	0.0005	0.001	0.0016	0.0005

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Manganese (total)	mg/l	0.022	0.022	0.022	0.0029	0.0029	0.0029	0.14	0.14	0.14
Nickel (total)	mg/l	0.009	0.022	<0.001	0.011	0.023	<0.001	0.020	<0.1	<0.001
Lead (total)	mg/l	0.015	<0.025	0.0011	0.019	0.031	<0.001	0.020	<0.025	0.0094
Antimony (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (total)	mg/l	0.0012	0.0012	0.0012	<0.001	<0.001	<0.001	0.001	0.001	0.001
Zinc (total)	mg/l	0.016	<0.025	<0.001	0.017	0.037	<0.001	0.015	<0.025	<0.001

Underlined numbers are 'less than'

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

POTTERS RIVER

BALLINCLARE STREAM

WICKLOW CO. CO. COMPOUND

EXISTING SITE ENTRANCE

L1157 LOCAL ROAD

QUARRY

KILMACURRAGH ARBORETUM

BARNDARRIG GAA

POTTERS RIVER

R772 REGIONAL ROAD

M11 MOTORWAY

1000m 500m 400m 300m 200m 100m

1 km

0 100 200 300 400m 600 800 1000

Metres 1:10,000

N

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAPPING WW030 & WW0311
2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50248253 (C ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND
3. EXISTING SURVEY (MAY 2016) PROVIDED BY KILSARAN

LEGEND

- LANDHOLDING BOUNDARY (c. 36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- INERT WASTE LANDFILL FOOTPRINT (c. 17.0 Ha.)
- C&D WASTE RECOVERY FACILITY AREA
- PROPOSED SOIL WASHING PLANT
- 500m, 1km, 2km & 3km DISTANCE OFFSETS FROM BOUNDARY
- RESIDENTIAL RECEPTORS
- COMMERCIAL RECEPTORS
- 002274 - DEPUTY'S PASS NATURE RESERVE SAC
- 001756 - GLENEALY WOODS pNHA
- R772 REGIONAL ROAD
- LOCAL ROAD NETWORK
- ACCESS TRACKS
- 220kV ELECTRIC OVERHEAD LINE
- RIVER / STREAMS
- HAUL ROUTE

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KILSARAN CONCRETE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BALLINCLARE QUARRY RESTORATION &
INERT WASTE & C+D WASTE RECOVERY FACILITY
KILBRIDE (N11), CO. WICKLOW

LOCAL RECEPTORS

FIGURE 7-1-3-2A

Scale 1:10,000 @ A3

Date FEBRUARY 2023

00036.00080.0.16.Figure 7-1-3-2A.Local Receptors.dwg

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAPPING WW030 & WW0311

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50248253 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

3. EXISTING SURVEY (MAY 2016) PROVIDED BY KILSARAN

LEGEND

- LANDHOLDING BOUNDARY (c. 36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- PROPOSED INERT LANDFILL AREA (c. 17.0 Ha.)
- D1 DUST MONITORING LOCATIONS
- N1 NOISE MONITORING LOCATIONS

N

ARRIGMORE

SETTLEMENT LAGOONS

BACK UP SETTLEMENT LAGOONS (IF REQUIRED)

CONCRETE YARD

WORKSHOP
CANTEEN
BUNDED FUEL TANKS
TOILETS
PUMPING CHAMBER
WEIGHBRIDGE
SITE OFFICE
CAR PARKING AREA
WHEELWASH
DISTRIBUTION ROOM & CONTROL SWITCH GEAR (AGGREGATE PLANT)
TERTIARY TREATMENT UNITS (2 MODULE PURAFLO)
ESB SUBSTATION & SWITCHROOM
AERATION TREATMENT UNIT
CAR PARKING AREA
LABORATORY
TOILETS
HAND STORAGE SHED

SITE NOTICE LOCATION @ SITE ENTRANCE

LOCATION	EASTING	NORTHING
Dust Monitoring Locations		
D1	725066	689280
D2	725520	688745
D3	724771	688969
Noise Monitoring Locations		
N1	725100	689316.
N2	725723	688585
N3	724820	688956

0 50 100 150 200m 300 400 500

Metres 1:4000

00036.00080.0.16.Figure 7-1-3-2B.Noise and Dust Monitoring Locations.dwg

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WASTE LICENCE APPLICATION

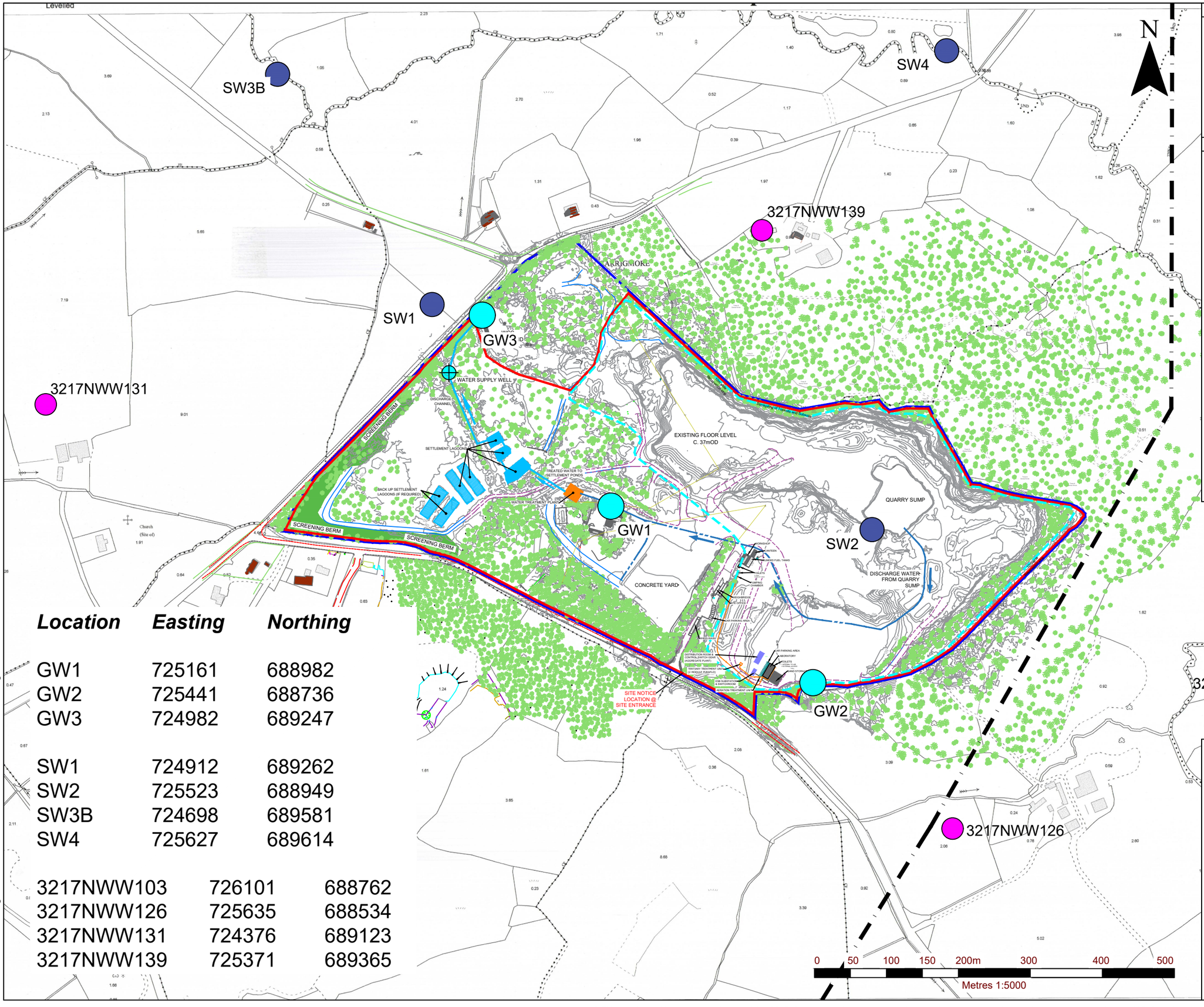
BALLINCLARE QUARRY RESTORATION
INERT LANDFILL & C+D WASTE RECOVERY FACILITY
KILBRIDE (N11), CO. WICKLOW

NOISE AND DUST MONITORING LOCATIONS

FIGURE 7-1-3-2B

Scale: 1:4,000 @ A3

Date: FEBRUARY 2023



Location	Easting	Northing
GW1	725161	688982
GW2	725441	688736
GW3	724982	689247
SW1	724912	689262
SW2	725523	688949
SW3B	724698	689581
SW4	725627	689614
3217NWW103	726101	688762
3217NWW126	725635	688534
3217NWW131	724376	689123
3217NWW139	725371	689365

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 1:2,500 / 1:5,000 MAP SERIES: 4137-B & 4137-D

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50248253 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

3. EXISTING SURVEY (MAY 2016) PROVIDED BY KILSARAN

LEGEND

- LANDHOLDING BOUNDARY (c. 36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- PROPOSED INERT LANDFILL AREA (c. 17.0 Ha.)
- CONTOURS
- INTERNAL ACCESS TRACKS
- OVERHEAD LINES
- PUMPED WASTE WATER FROM SURFACE RUNOFF

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WASTE LICENCE APPLICATION

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INERT LANDFILL & C+D WASTE RECOVERY FACILITY
KILBRIDE (N11), CO. WICKLOW

SURFACE WATER AND GROUNDWATER MONIRORING LCATION

FIGURE 7-1-3-2C

Scale: 1:5,000 @ A3

Date: FEBRUARY 2023

00036.00080.0.16.Figure 7-1-3-2C.Surface and GW Mon Locations.dwg