

Environmental Impact Assessment Report

Volume 2: EIAR Report

Saint Gobain Construction Products (Ireland)

5TH November 2020

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Quality information

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Acronyms

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AER	Annual Environmental Report
AGI	Above Ground Installation
ASI	Archaeological Survey of Ireland
ATC	Automatic Traffic Counts
BC	British Columbia
BoCCI	Birds of Conservation Concern in Ireland
BOD	Biochemical Oxygen Demand
BSI	British Standards Institute
ca.	circa
Ca	Calcium
CaCO ₃	Calcium carbonate
Ca(OH) ₂	Lime
CAP	Climate Action Plan
CCR	Climate Change Resilience
CCTV	Closed Circuit Television
CDP	County Development Plan
CDW	construction demolition waste
CFRAM	Catchment Flood Risk Assessment and Management
CIEEM	Chartered Institute for Ecology and Environmental Management
chNA	Candidate National Heritage Area
CDM	Clean Development Mechanism
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide equivalent
COD	Chemical Oxygen Demand
CP	Compliance Point
CRAMP	Closure Restoration and Aftercare Management Plan
CSO	Central Statistics Office
CURWMP	Connacht - Ulster Region Waste Management Plan
DAHG	Department of Arts, Heritage and the Gaeltacht
dB	Decibels
DCCAE	Department of Communications, Climate Action and Environment
DCHG	Department of Culture, Heritage and the Gaeltacht
C&D	Construction and Demolition
DEHLG / DoEHLG	Department of the Environment, Heritage and Local Government
DHPLG	Department of Housing, Planning and Local Government
Diam.	Diameter
DO	Dissolved Oxygen
EC	European Commission
EC	Effective Concentration / toxin concentration
ED	Electoral Division
EEA	European Economic Area

EF	Emission Factors
EFTA	European Free Trade Association
e.g	For example
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIC	Electrocoagulation
ELV	Emissions Limit Value
EMRWMP	Eastern-Midlands Region Waste Management Plan
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Product Declaration
EPT Taxa	Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)
EQS	Environmental Quality Standards
ESB	Electrical Supply Board
ESD	Effort Sharing Decision
ETS	Emissions Trading System
EU	European Union
GAA	Gaelic Athletic Association
GAC	Generic Assessment Criteria
GHG	Greenhouse Gas
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GNI	Gas Networks Ireland
GRG	Glass Reinforced Gypsum
GSI	Geological Survey Ireland
Ha	Hectares
HSA	Health and Safety Authority
HUDU	Healthy Urban Development Unit
ICCI	In-Combination Climate Change Impact
IE	Industrial Emissions
IED	Industrial Emissions Directive
IEL	Industrial Emissions Licence
IEMA	Institute of Environmental Management and Assessment
IFC	International Finance Corporation
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
IGV	Interim Guideline values
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention Control
IPH	Institute of Public Health
IPPC	Integrated Pollution Prevention Control
ISO	International Organisation for Standardisation
ITM	Irish Transverse Mercator
IUCN	International Union for Conservation of Nature
I-WeBS	Irish Wetland Birds Surveys
JA	Jobseekers Allowance

JB	Jobseekers Benefit
JI	Joint Implementation
kg	kilogram
kg/hr	Kilogram per hour
kHz	kilohertz
km	Kilometre
kV	Kilovolt
KWH	Kilowatt Hours
LAeq	A-weighted, equivalent continuous sound level
LAeq T	A-weighted, equivalent continuous sound level. T denotes the time period over which the fluctuating sound levels were averaged
LAF90	Statistical analysis of noise levels. The n denotes the percentage exceedance, for example the value of L90 shows the noise level that was exceeded for 90% of the measurement duration
LC	Lethal Concentration
LaCA	Landscape Character Assessment
LCA	Life Cycle Assessment
LCAs	Landscape Character Areas
LCT	Landscape Character Type
Leq	equivalent continuous sound level
LFS	Labour Force Survey
LL	Lower Limit
LoW	List of Waste
LV	Low Voltage
m	Meter
MACC	Marginal Abatement Cost Curve
MA&D	Major Accidents and Disasters
mbgl	Metres below ground level
m ²	Square Meter
m ³	Cubic Meter
m ³ /day	Cubic Meter per day
m ³ /hr	Cubic Meter per hour
Mg	Magnesium
MGWR	Ireland's Midland Great Western Railway
Mg/L	Milligrams per Litre
mg/m ³	Milligram per cubic meter
mg/m ² /day	Milligram per square meter per day
mm	Millimetres
mm/second	Millimetres per second
mol/m ³	Mole per meter cubed
MRP	Molybdate Reactive Phosphorus
MSDS	Material Safety Data Sheets
MtCO ₂ eq	Million tonnes of Carbon Dioxide Equivalent
M tonnes	Million tonnes
MV	Medium Voltage
MW	Megawatt
MWHrs	Megawatt-hours
NAF	National Adaptation Frameworks

NBDC	National Biodiversity Data Centre
NCCAF	National Climate Change Adaptation Framework
NCV	Net Calorific Value
NDC	Nationally Determined Contributions
NF ₃	Nitrogen Trifluoride
NHA	Natural Heritage Area
NHS	National Health Service
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
NMP	National Mitigation Plans
NMS	National Monument Service
NRA	National Roads Authority
N	Nitrogen
NO ₂	Nitrogen Dioxide
NO ₃	Nitrate
NO _x	Oxides of Nitrogen
NPF	National Planning Framework
NPWS	National Parks and Wildlife Service
OD	Ordnance Datum
OPW	Office of Public Works
OSEC	On site electrochlorination
OS	Ordnance Survey
OSI	Ordnance Survey Ireland
P	Phosphate
PAS	Publicly Available Specification
PE	Polyethylene pipe
pH	A scale of acidity from 0 to 14
PI	Predicted Interval
pNHA	Proposed Natural Heritage Area
ppt	Part per thousand
PV	Parametric Value
PWS	Private Water Supply
Q1	Quarter 1
QI	Qualifying Interest
Q Value	Ecological quality rating for rivers and streams
R ²	Coefficient of determination / correlation coefficient
RAL	Remedial Action List
RMP	Record of Monuments and Places
RO	Reverse Osmosis
RPS	Record of Protected Structures
SAC	Special Area of Conservation
SCI	Special Conservation Interest
SGCPIL	Saint-Gobain Construction Products (Ireland) Limited.
S.I.	Statutory Instruments
SO ₄	Sulphate
SPA	Special Protection Area
SPZ	Source Protection Zone

TDS	Total Dissolved Solids
TII	Transport Infrastructure Ireland
TSS	Total Suspended Solids
TTA	Traffic and Transport Assessment
UL	Upper Limit
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
uPVC	Unplasticised polyvinyl chloride
UWWT	Urban Waste Water Treatment
V	Volts
WFD	Water Framework Directive
WHO	World Health Organisation
WMP	Water Management Plan
WWTP	Wastewater Treatment Plant
Zoi	Zone of Influence
µg/L	Micrograms per Litre
µm	Micrometre
µS/cm	Microsiemens Per Centimetre is a unit in the category of Electric conductivity
%	Percent
°C	Degrees Celsius

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1 Introduction

1.1 General

Saint-Gobain Construction Products (Ireland) Limited (here after referred to as the 'Applicant'), a wholly owned subsidiary of Saint-Gobain owns and operates the Drummond underground mine, Knocknacran open –pit mine and a number of decommissioned underground mines located in Co. Monaghan (hereafter referred to as the 'mine site'). Drummond underground mine and Knocknacran open –pit mine are existing gypsum mines. The company are the only manufacturer of gypsum in Ireland and supplier of plaster, plaster board and dry-lining systems to the Irish construction industry. The company's Knocknacran open – pit mine has been in operation since 1989 while Drummond underground mine has been in operation since 2007. The gypsum extracted from the mine site is used to supply a factory owned by the applicant located in Lisnabow, Kilmainhamwood, co. Meath. The factory produces plaster and plasterboard and is owned by Saint-Gobain (hereafter referred to as the 'factory site'). The mine site is located circa 7 km north of the factory site (see Figure 1-1).

Activities at the mine and factory site have operated under licence since the 25th of July 2002 (P0519-01). A revised licence was issued in 2005 on the 18th of February (P0519-02), which was subject to an additional review and amendment on the 30th of July 2015 (P0519-03) (RPS 2018). Both the mine site and the factory site are physically distant from one another (circa 7 km from each other; Figure 1-1) however they currently operate under the same Industrial Emissions Licence (IEL) No. P0519-03, dated July 2015. The IEL details the site emission requirements, discharge points, monitoring parameters, and the required monitoring frequency at both the mine and factory sites.

The existing IEL covers the following activities (EPA 2015; SLR 2019a)

- Class 1.3 - the extraction and processing of minerals
- Class 11.1 - the recovery or disposal of waste in a facility, and
- Class 11.5 – landfill.

Following a recent alteration in the existing water management procedure at the Drummond mine site the Applicant is applying for a review of the existing IEL No. P0519-03. This IEL review applies to the mine site operations only and will seek to increase the current compliance limit values for sulphate and electrical conductivity at Compliance Point CP-1.

Conductivity is closely connected to sulphate concentration, such that lowering sulphate concentration causes lower conductivity, and conversely raising sulphate concentration increases conductivity. Thus, regulation of sulphate concentration proportionately regulates the associated conductivity. In light of this, the proposed IEL review seeks to increase the current ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point 1 (hereafter referred to as the Proposed Licence Amendment).

The increased limit of sulphate of 1,250 mg/L and electrical conductivity of 2,360 µS/cm would facilitate normal operation as well as exceptional and emergency flows. Compliance Point CP-1 is located circa 70 m downstream of a discharge point into the River Bursk. The emission at the discharge point upstream of Compliance Point CP-1 is mainly natural groundwater with a small proportion of surface water run-off which has come in contact with gypsum mineral underground and does not include process water or effluent (SLR 2019a).

This Environmental Impact Assessment Report (EIAR) will comprise baseline information at both the mine site and factory site, however the Proposed Licence Amendment does not change any other aspects of the IEL outside of a proposed increase in sulphate and electrical conductivity at Compliance Point CP-1 at the mine site.

All other aspects of the IEL are to remain unaltered and no aspect of the proposed increase in sulphate or electrical conductivity limit at Compliance Point CP-1 has potential for cumulation of impacts between the mine and factory sites due to their being physically distant from each other (except where specifically stated within the EIAR). This report will accompany the licence review application to the Environmental Protection Agency (EPA).

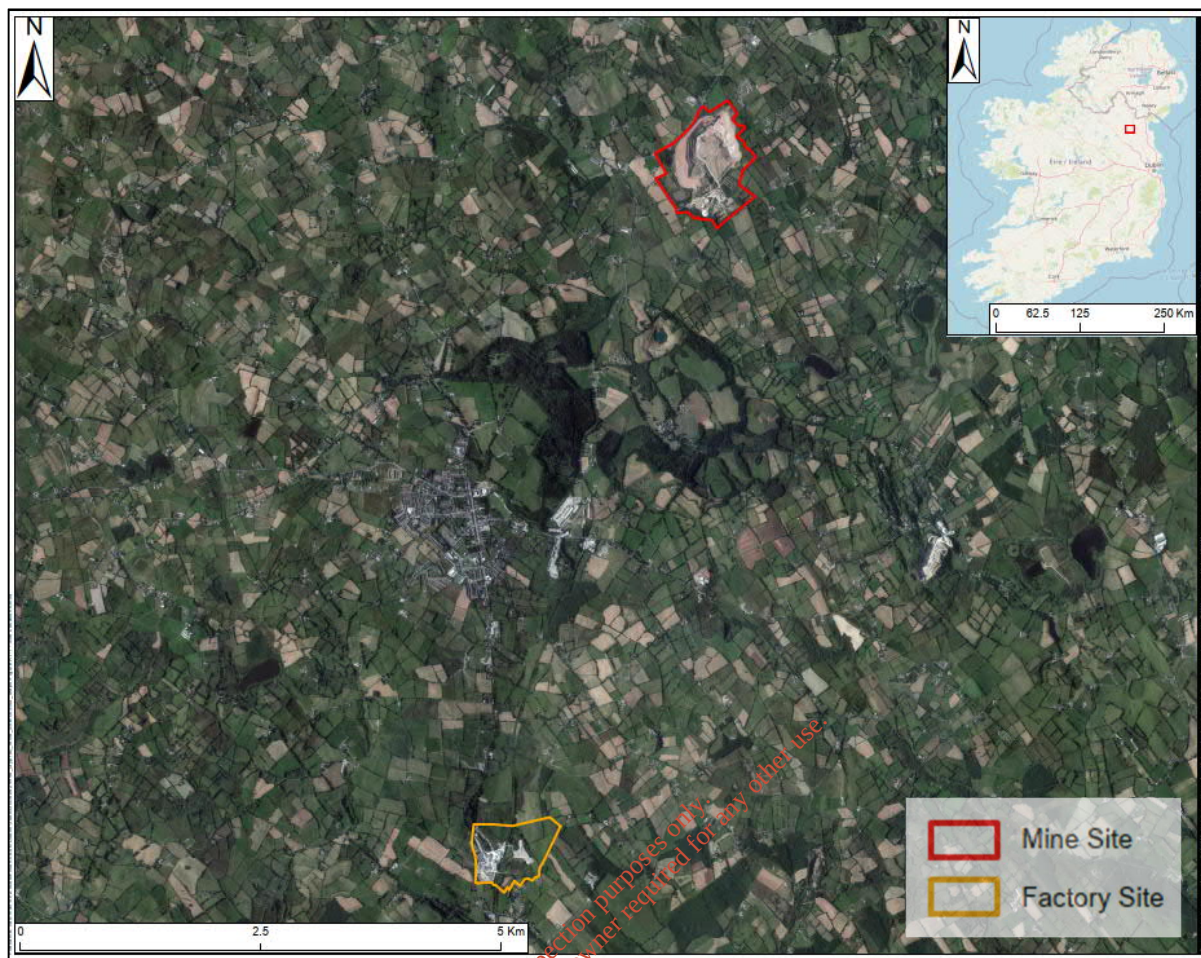


Figure 1-1 Mine Site and Factory Locations (Volume 3, Appendix A1.1, Figure A1-1)

1.2 Need for the Proposed Licence Amendment

Following an unexpected ingress of water into Drummond mine in June 2018 and the subsidence of the decommissioned Drumgoosat mine in September 2018, there was a change in the water management procedure at the mine site for water which had come in contact with gypsum (SLR 2019a). Prior to the unexpected ingress, water from the Drummond mine was routinely diverted to the decommissioned Drumgoosat mine for storage to allow the rate of discharge of water from the site to be varied in response to seasonal flows in the receiving water of the River Bursk. It was decided in consultation with the EPA, Monaghan County Council and the DCCAE who with company representatives formed a joint Technical Group in response to the subsidence event, that as a precautionary measure, the water stored in the decommissioned mine should be removed and seasonal water storage in these mine workings should be avoided. The site's water management plan was revised to reflect this, (see SLR 2019a).

As part of the previous and existing water management procedure, all water from the site that has the potential to be in contact with Gypsum and contain elevated sulphate levels including, mine water, storm water, and wheel wash water is collected and pumped to the lagoon systems at the mine site (no waste water is included in water pumped to this area, waste water is treated separately on-site). The water is allowed to settle within the lagoons before flowing to a holding tank and finally discharged to the River Bursk at emissions point MSE-1 (EPA 2013). Emissions point MSE-1 is located approximately 70 m upstream of Compliance Point CP-1.

Water was stored and released to the River Bursk when flow conditions facilitated dilution at the downstream Compliance Point CP-1 (SLR 2019b). This in effect allowed the concentration of sulphate at Compliance Point CP-1 to remain within the licence limit of 200 mg/L. As water can no longer be stored and discharged, all discharge is now discharged directly off site to the existing discharge point on the River Bursk (SLR 2019a). As the capacity of the River Bursk to dilute sulphate is reduced during periods of low flow, this can result in higher concentrations of sulphate at Compliance Point CP-1 at certain times of the year.

To facilitate discharge of mine water from the mine site, a review of IEL P0519-03 is required to obtain an increased emission limit value (ELV) for sulphate at Compliance Point CP-1 from 200 mg/L to 1,250 mg/L and electrical conductivity from 1000 µS/cm to 2,360 µS/cm.

1.2.1 Rationale for Industrial Emissions Licence (IEL) Review

Following the water ingress to the Drummond mine and the subsidence of Drumgoosat Mine, the subsequent direct discharge of mine water from the mine site to the River Bursk during lower flows in the river (during the summer period, between April and September) has resulted in a continued risk of potential breach of the IEL compliance for sulphate (200 mg/L) and electrical conductivity (1000 µS/cm) in the River Bursk at Compliance Point CP-1.

1.3 EIA Legislation and Guidance

The EPA carried out an Environmental Impact Assessment (EIA) Screening Determination in accordance with section 83(2A) of the EPA Act 1992, as amended, as part of its consideration of the IEL application review (application made by the Applicant for a licence review on the 04th July 2019 to the EPA). The Applicant is carrying out this EIAR to identify any potential significant effects of the Proposed Licence Amendment.

EIA requirements derive from Council Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC) and as codified and replaced by Directive 2011/92/EU of the European Parliament and the Council on the assessment of the effects of certain public and private projects on the environment. Amending EIA Directive 2014/52/EU, constitutes an update of the preceding Directive 2011/1192/EU. Directive 2014/52/EU was transposed into Irish law on 16 May 2017 and came into effect in Ireland on 1 September 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

Guidelines which have been considered during the undertaking of the EIA and in preparation of the EIAR have included:

- The requirements of European Commissions Directives and Irish Regulations regarding EIA such as European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018); the Planning and Development Act (2000-2019), and the EIA Directive 2014/52/EU (EU 2014)
- Environmental Protection Agency, 'Guidelines on the Information to be Contained In Environmental Impact Assessment Reports' (Draft August 2017) (EPA 2017)
- European Commission, 'Environmental Impact Assessment of Projects, Guidance on the preparation of Environmental Impact Assessment Reports' (Directive 2011/92/EU as amended by 2014/52/EU) (2017)
- European Commission, 'Interpretation of definitions of project categories of annex I and II of the EIA Directive' (2015) (EC 2015)
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, 2018 (DoHLGH 2018), and
- Other guidelines relevant to the environmental aspects assessed, as noted in specific chapters of the EIAR.

An EIAR is defined by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) as:

"...a report of the effects, if any, which proposed development, if carried out, would have on the environment and shall include the information specified in Annex IV of the Environmental Impact Assessment Directive".

The primary objective of the EIAR is to identify baseline environmental and socio-economic conditions in the proposed development area, identify significant environmental effects, predict potential beneficial and / or significant adverse effects of the proposed development and propose appropriate mitigating measures where necessary.

This EIAR assesses, as required, the direct effects and any indirect, secondary, cumulative, short term, medium term and long term permanent and temporary, positive and negative effects of the Proposed Licence Amendment.

1.4 EIA Methodology

EIA is the process for anticipating the effects (both positive and negative) from a project on various environmental receptors. The process runs in parallel with the design of a project, facilitating the feedback of environmental information into the design process if applicable. If the anticipated effects are considered likely to be significant, design measures or other relevant mitigation measures could be taken to avoid, prevent and/or reduce those effects. The EIAR is then the document which records the details of the assessments undertaken to identify the likely significant effects of a project on the receiving environment.

The EIA process can involve several stages: screening, scoping, baseline surveys, impact assessments ongoing feedback into the proposed development, and preparation of the EIAR. The EIAR is then submitted to the EPA. The EIAR must include the relevant information and assessments in accordance with the aforementioned legal provisions in order for the appropriate authority to come to a reasoned conclusion on the significant effects of the proposed development (in this case the Proposed Licence Amendment) on the environment.

Directive 2014/52/EU states that “environmental impact assessment” is a process consisting of:

- i. *‘The preparation of an environmental impact assessment report by the Applicant, as referred to in Article 5(1) and (2)*
- ii. *The carrying out of consultations as referred to in Article 6 and, where relevant, Article 7**
- iii. *The examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the Applicant in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7*
- iv. *The reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination, and*
- v. *The integration of the competent authority’s reasoned conclusion into any of the decisions referred to in Article 8a.’*

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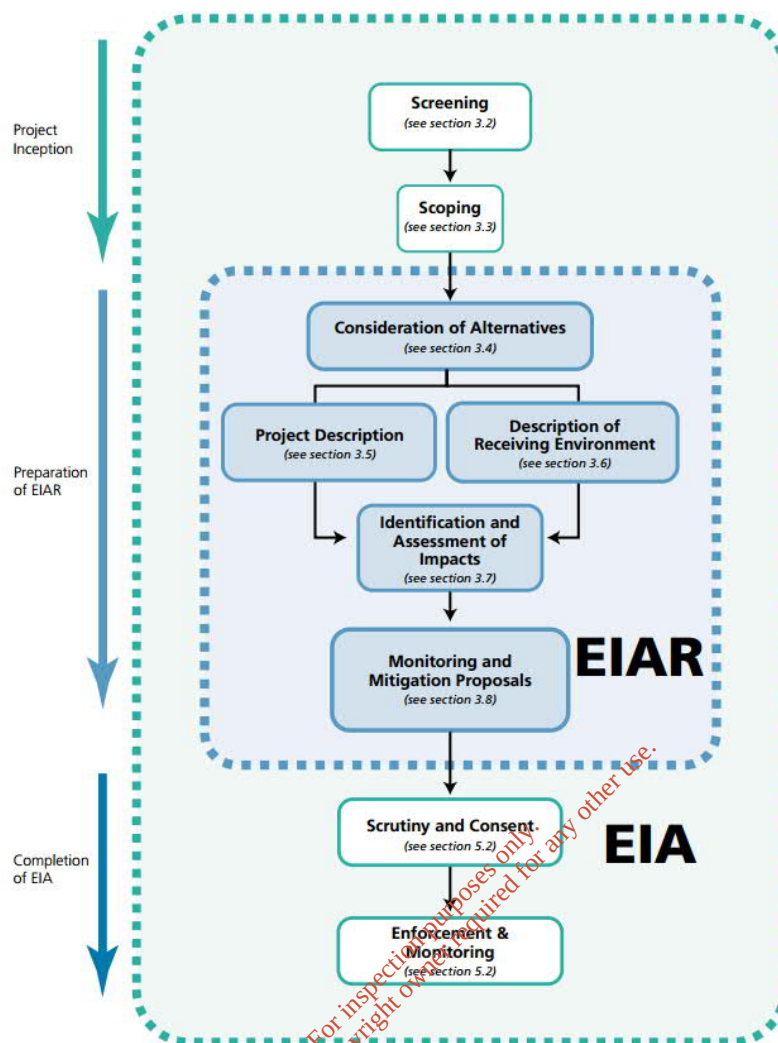


Figure 1-2 The EIA Process (after EIAR Draft Guidelines, EPA, 2017)

1.5 Screening

The screening phase identifies if the EIA process is required or not. The EPA carried out an EIAR screening review under Section 83 (2A0 of the EPA Act 1992 as described in section 1.3 of this EIAR, on the Proposed Licence Amendment and determined that an EIAR was required. The determination noted:

"Having considered the information provided by the applicant, it has been determined that the activity constitutes a project to which the EIA Directive applies and is likely to give rise to significant effects on the environment by virtue of its nature, size and location".

1.6 Scoping

Scoping is an essential element of the EIA process and is carried out in order to identify and confirm the likely significant environmental effects of the Proposed Licence Amendment that should be addressed in the EIAR. It is defined in the European Commission (EC) guidance as: *"determining the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR"*. Scoping is then *'the process of identifying the content and extent of the information to be submitted to the Competent Authority under the EIA process'* (EC Environmental Impact Assessment of Projects, Guidance on Scoping, 2017).

The main purpose of the scoping process is to:

- Consider the potential for likely significant environmental effects from the Proposed Licence Amendment
- Identify which environmental areas are not likely to experience significant environmental effects and therefore can be scoped out of the EIA and identify which technical areas may be subject to significant effects or for which sufficient information is not available, and therefore, would need to be scoped into the EIA for further assessment
- For Effects scoped into the EIA:
 - Identify data and appropriate surveys to be undertaken to establish the existing baseline
 - Outline the scope and assessment methodology for determining likely significant environmental effects.

A scoping report was carried out as part of this assessment. Consultation with the EPA (04/03/20) has identified that the EIAR is to include a baseline position for all environmental topics and a subsequent impact assessment evaluation for environmental topics potentially impacted by the Proposed Licence Amendment.

The scoping response identified the requirement to:

- Identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of a project on each of the factors listed in Article 3 of the EIA Directive
- Address the entire activity, and not just what is the subject of the licence review application
- Address the matters raised in the responses received from Inland Fisheries Ireland (IFI) and Geological Survey Ireland (GSI)
- Have regard to the requirements of the draft Guidelines on the information to be contained in Environmental Impact Assessment Reports, as appropriate
- Have regard to the relevant topics contained in the EPA's Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) September 2003 and
- Satisfy the requirements of the EIA Directive

1.7 Format of the Environmental Impact Assessment Report

After scoping, the detailed EIA and preparation of the EIAR is undertaken. The EIA involves determination of the baseline status of the existing environment, evaluation of the likely significant effects of a project and determining their significance, determining appropriate mitigation and monitoring measures and assessing any residual effects. The findings of the EIA are then documented within the EIAR.

Directive 2014/52/EU Article 5, Paragraph 1 requires an EIAR to include:

- 'A description of the project*
- A description of the likely significant effects of the project on the environment*
- A description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment*
- A description of the reasonable alternatives studied by the Applicant, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment*
- A non-technical summary of the information referred to in points (a) to (d) and*
- Any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected'*

The structure of this EIAR is outlined below (Table 1-1) and is in accordance with Article 3 of the EIA Directive. Table 1-1 also identifies where information on the existing baseline has been provided but a full environmental assessment was scoped out (highlighted in grey in Table 1-1).

Table 1-1 Environmental Impact Assessment Report Structure

Volume	Chapter	Content
Volume 1	Non-technical Summary	Summary of all chapters included within the EIAR
Volume 2	Chapter 1	Introduction
	Chapter 2	Examination of Alternatives
	Chapter 3	Project Description
	Chapter 4	Traffic and Transport (baseline provided, detailed assessment scoped out)
	Chapter 5	Population and Human Health
	Chapter 6	Biodiversity
	Chapter 7	Land and Soils (existing baseline provided, detailed assessment scoped out)
	Chapter 8	Water
	Chapter 9	Air Quality (existing baseline provided, detailed assessment scoped out)
	Chapter 10	Climate (existing baseline provided, detailed assessment scoped out)
	Chapter 11	Noise and Vibration (existing baseline provided, detailed assessment scoped out)
	Chapter 12	Landscape and visual (existing baseline provided, detailed assessment scoped out)
	Chapter 13	Cultural Heritage (existing baseline provided, detailed assessment scoped out)
	Chapter 14	Material Assets (existing baseline provided, detailed assessment scoped out)
	Chapter 15	Waste (existing baseline provided, detailed assessment scoped out)
	Chapter 16	Risk of Major Accidents and Disasters (existing baseline provided, detailed assessment scoped out)
	Chapter 17	Interaction of the Foregoing
	Chapter 18	Mitigation, Monitoring and Further Studies
Volume 3	Appendices	Various appendices to accompany the technical assessment chapters

The general structure of each technical assessment chapter and methodology adopted for undertaking the technical assessments presented in this EIAR is in accordance with the EPA's draft '*Guidelines on the information to be contained in EIAR*' (EPA, 2017). Where regulatory or more specific methodology guidance relevant to an individual environmental aspect is available, this is detailed within the technical impact assessment chapters. In addition, the project specific format of the EIAR in terms of that presented in table 1-1 above was helpfully proposed by the EPA and agreed in advance, during consultation at Scoping stage.

1.8 Consultation

AECOM understanding from correspondence between the Applicant and the EPA is that the EIAR will be provided to the EPA prior to consultation occurring and the EPA will carry out consultation with relevant statutory and non-statutory bodies should it be required.

1.9 Expertise of the EIAR Team

Table 1-2 provides the names of the main contributor to each of the EIAR chapters, along with their relevant qualifications.

Table 1-2 Expertise of EIA Team

EIAR Chapters/Role	Consultant	Qualification
Project Manager	Danny Ward	Associate Environmental Consultant BSc, MSc, Diploma in Occupational Health & Safety, NEBOSH
EIAR Co-ordinator	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc

	EIAR Chapters/Role	Consultant	Qualification
1	Introduction and Need for the Project	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
2	Examination of Alternatives	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
3	Project Description	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
4	Traffic and Transport	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Noelle O'Leary	Environmental Consultant BSc (Hons), MSc, MEnvSc
5	Population and Human Health	Dave Widger	Regional Director, BSc (Hons), MSc (Econ)
		Monica Laucias	Consultant - Economic Development
6	Biodiversity	Tony Marshall	Associate Director, BSc (Hons) MCIEEM
		Vick Dadds	Principle Ecologist BSc (Hons) MCIEEM
7	Land and Soils	Matteo Viganotti	Principle Environmental Engineer, M.Sc., PhD, MIEI
		Amy Turner	Environmental Consultant B Eng. (Hons), B.Sc. (Hons)
8	Water (Hydrology and Hydrogeology)	Matteo Viganotti	Principle Environmental Engineer, M.Sc., PhD, MIEI
		Amy Turner	Environmental Consultant B Eng. (Hons), B.Sc. (Hons)
9	Air Quality	Glenn McKay	Principal Environmental Consultant BSc MSc MCIWEM C.WEM CEnv CSci
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
10	Climate	Glenn McKay	Principal Environmental Consultant BSc MSc MCIWEM C.WEM CEnv CSci
11	Noise and Vibration	Barry Sheridan	Technical Director E&P BA (Mod) Env
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
12	Landscape and Visual	Joerg Schulze	Associate Landscape Architect, Dipl.-Ing. (FH), LA, MILI

EIAR Chapters/Role		Consultant	Qualification
		Blade, Kathryn	Landscape Architect
13	Cultural Heritage	David Kilner	Senior Archaeological Consultant, BA (Hons), PG Dip, MSc, MIAI
14	Material Assets	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
15	Waste	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
16	Risk of Major Accidents and Disasters	Alison Couley	Associate Consultant, Process Safety
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.
17	Interactions of the forgoing	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MEnvSc
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD, MEnvSc.

Alison Couley is an Associate Process Safety Consultant within AECOMs Air Quality and Compliance team. A chartered Chemical Engineer with over 24 years' experience in the process and manufacturing industries, including oil and gas processing, chemicals and petrochemicals. Alison has worked in process safety and environmental compliance consultancy for over 15 years, including Seveso/COMAH, ATEX/DSEAR and Environmental Permitting compliance, is an experienced HAZID study leader and an IChemE accredited HAZOP study leader.

Amy Turner is an environmental consultant based in AECOMs Dublin office who has five years' experience in environmental consultancy work, specialising in contaminated land projects. Amy has worked as the field manager and primary author on large scale investigation and remediation projects dealing with petroleum hydrocarbons, chlorinated hydrocarbons and per and poly fluoroalkyl substances.

Barry Sheridan is Technical Director and Head of Environment & Planning in Ireland. Barry has over 19 years of professional experience in a variety of areas within the environmental management, impact assessment, licensing, auditing sector and due diligence constraints/threat assessment area. He has experience of environmental impact assessment and planning consents for projects in Ireland & the United Kingdom (UK). Barry has acted as technical reviewer of deliverables in the EIAR space for AECOM on this project

Danny Ward is an Associate Consultant within the Environmental Liability Solutions, Environmental & Ground Engineering Group in the AECOM Dublin office. Danny has over 18 years of professional experience in a variety of areas including EHS Auditing, technical and environmental due diligence, environmental licensing, and regulatory enforcement support to the Irish EPA.

David Kilner has over 18 years of experience working in the heritage sector. Prior to joining AECOM, David was Senior Archaeologist with a commercial archaeological company based in Belfast which involved working all over Ireland. His experience covers a range of projects, from planning advice to archaeological baseline research and EIA to procuring and managing archaeological specialists and sub-contractors undertaking field survey.

Dave Widger is a Regional Director in the Economic Development & Regeneration Team with over 19 years' experience in economic development and regeneration with particular expertise in health impact assessment, and community and socio-economic impact assessment of major mixed-use and infrastructure schemes. David is an experienced Technical Lead with significant experience of working with internal and external staff

to deliver complex, major infrastructure projects. He has worked on and led population and health assessments for High Speed 2, Heathrow, A303 Stonehenge and Dublin Airport

Elaine Keenan is an Environmental Consultant and a full member of The Institute of Environmental Sciences, who provides technical support to the environment and planning team across a range of multidisciplinary projects. Elaine has produced documents such as EIA Screening Reports and has inputted into chapters for both EIA Scoping Reports and EIAR. Elaine also co-ordinates aspects of EIA as part of EIAR deliverables and carries out environmental site inspections.

Glenn McKay is a Principal Environmental Consultant, primarily responsible for undertaking Environmental Impact Assessments (EIA) and Environmental Appraisals of major infrastructure projects. He has been with AECOM since 2004, affording him the opportunity to work on major projects from inception through to construction. He has over fifteen years' experience of carrying out EIA for major infrastructure projects and development proposals, and in particular a range of major road projects throughout Ireland. The assessments have included the preparation of both Scoping Reports and Environmental Impact Assessment Reports.

He has fulfilled the role of air quality expert on numerous infrastructure projects to date, ranging from high standard dual carriageways to local relief roads. Glenn also has experience of on-site monitoring/inspection and resolution of construction-related environmental issues, in line with Contractual requirements. In particular, this has included preparation of Air Quality Management Plans and identifying on-site construction related air quality issues, such as dust emissions and identifying appropriate mitigation measures.

Joerg Schulze has over 16 years' professional experience working for clients in the private and public sector. He has a comprehensive track record in developing and managing landscape and visual impact assessments of large industrial, commercial, residential, infrastructural, renewable energy, tourism and civic developments throughout the island of Ireland. He has extensive experience in all stages of the planning, design, tender and implementation process, contract management and as consultant for Part 8 and EIA processes. His master planning experience includes advice on mitigation measures to minimise landscape and visual impacts, the preparation of detailed mitigation planting schemes and general landscape design within proposed development sites to facilitate staff, visitor, tourism and/or local community requirements. As part of the landscape and visual impact assessment process, Joerg is also an expert in developing constraints studies, site suitability assessments, feasibility studies and associated mapping. He has prepared residential visual impact assessments, manages the production of photomontages and the preparation of zones of theoretical visibility and theoretical visual intensity mapping.

Matteo Viganotti has 15 years of experience in environmental consultancy and research in Italy, Ireland and the UK. He currently acts as a Technical Project Manager on several projects focussing on contaminated land and environmental compliance issues. Matteo has successfully managed and collaborated in a substantial number of contaminated land projects for the construction, industrial, manufacturing, mining, pharma, and IT industries. His experience ranges from the management of remediation efforts for contaminated sites to the development and implementation of environmental monitoring plans for large infrastructure projects.

Niamh O'Connell is a Chartered Environmental Scientist in the AECOM Environment and Planning Team and has more than 15 years' post-graduate experience. She graduated with an honour's degree in Environmental Sciences from Trinity College (2000) and has since earned two post graduate diplomas in Environmental Eng. (TCD, 2004) and Business Studies (UCD, 2001) and a Masters in Project Management (UCD, 2010). She has extensive experience of major design projects for both public and private sector clients taking projects from feasibility through, EIAR, the planning process and through detailed design and construction phases.

Nick Dadds is a Principal ecologist of 19 years' experience with particular expertise in ecological impact assessment, protected species and National Vegetation Classification (NVC). He has been responsible for high quality and well-received EIA and Natura-related assessments, as well as ecological mitigation and protected species licensing, for a variety of statutory and private clients. Projects he has been involved with range from large-scale infrastructure and energy schemes (including wind farms, pipelines, power lines, transport projects and masterplan schemes) to conservation-related projects (including commissioned work for Scottish Natural Heritage).

Noelle O Leary is an Environmental Consultant within the Environment and Planning Group in the AECOM Cork office. Noelle has a Bachelor of Science (B.Sc.) in International Field Geosciences, a joint degree awarded from the University College Cork, Ireland and the University of Montana, USA; and a Master of Science (M.Sc.) in Ecosystem Services from the University of Edinburgh, Scotland. Noelle is an Associate Member of the Institute of Environmental Sciences (IES).

Tony Marshall is an Associate Director within AECOM's ecology team. He leads the team of ecologists in Scotland and has been involved in managing the delivery of the ecological aspects of a number of development projects across the Republic of Ireland. He has ten years of experience as a professional ecological consultant. He is experienced in preparing, reviewing and verifying Ecological Impact Assessments. Tony is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and sits on the Scottish Section Committee of this professional body.

Noelle has worked as a Junior Geologist in Perth, Western Australia for 2.5 years; gaining valuable experience in managing a range of field projects and supervising on site activities. Additional experience includes conservation management, community engagement and ecosystem services assessments; gained from volunteering abroad and conducting short contracts for a number of environmental groups in Scotland. Noelle is responsible for co-ordinating aspects of EIA as part of EIAR deliverables and carries out environmental site inspections.

1.10 Difficulties Encountered

To date the majority of licence reviews and planning applications have related specifically to the mine site only and as such there is less information available for the factory site. An EIAR is not required for the factory site and as such detailed baseline information is not available for the factory site for all chapters. However in general the information is being included for baseline information only and does not affect the consideration of potential impacts of the Proposed Licence Amendment.

The EPA have required as part of this application that a baseline for the factory site is provided for all environmental topics. This has been done where possible herein based on the information currently available.

The assessment is based upon and includes baseline information provided by the Applicant and third parties. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the environment. Any information provided by the Applicant and/or third parties and referred to and / or included herein (such as figures, graphs, traffic and transport assessments and baseline information) has not been checked or verified by AECOM. This relates predominately to chapters where only baseline information has been provided.

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2 Examination of Alternatives

2.1 Introduction

The 2014 EIA Directive was transposed into Irish law on the 16th May 2017 and came into effect in Ireland on the 1st September 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018. Where relevant alternatives should include; sites, routes, layouts, processes, technology, size, scale and strategies. As this EIAR relates to an IEL review, consideration to things such as routes and layouts amongst others were deemed not applicable as no infrastructure will be built as part of this application.

Article 5(1)(d) of the EIA Directive 2014/52/EU (EU 2014) requires an EIAR to contain:

"A description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".

EIA guidance and legislation requires that consideration of these alternatives should include, where relevant; design, location, routes, alignments/layouts, processes, technology, size, and scale.

The Department of Housing, Planning and Local Government, Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment (DHPLG 2018) state: *"Reasonable alternatives may relate to matters such as project design, technology, location, size and scale. The type of alternatives will depend on the nature of the project proposed and the characteristics of the receiving environment. For example, some projects may be site specific so the consideration of alternative sites may not be relevant. It is generally sufficient for the developer to provide a broad description of each main alternative studied and the key environmental issues associated with each. A 'mini- EIA' is not required for each alternative studied."*

Pursuant to Section 3.4.1 of the Draft EPA Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017), the consideration of alternatives also needs to be cognisant of the fact that *"in some instances some of the alternatives described below will not be applicable – e.g. there may be no relevant 'alternative location'..."*. The Draft 2017 Guidelines are also instructive in stating: *"Analysis of high-level or sectoral strategic alternatives cannot reasonably be expected within a project level EIAR... It should be borne in mind that the amended Directive refers to 'reasonable alternatives... which are relevant to the proposed project and its specific characteristics'".*

The existing IEL P0519-03 covers emissions limits, monitoring points and frequency of monitoring required for both the mine site and the factory site. The mine site comprises an open pit gypsum mine, underground gypsum mine, settlement lagoons, a workshop area, offices, site facilities and site infrastructure. Activities at the mine site include crushing plant, lorry loading facilities, a workshop, storage silos, office buildings and a water lagoon system. The gypsum is mined above and below ground at the mine site and is transported by road to the factory site where it is converted to gypsum plaster boards or builders' plaster. The factory site consists of process areas, workshops, offices, a capped landfill and four settlement lagoons.

This Proposed Licence Amendment relates to a request by the Applicant to the EPA to increase the emission limit value for sulphate from 200 mg/L to 1,250 mg/L and electrical conductivity levels from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 at the mine site. The requirement for a licence review arose following the unexpected ingress of water into Drummond mine in June 2018 and the subsidence of the decommissioned Drumgoosat mine in September 2018. Following this it was decided water could no longer be diverted to the decommissioned Drumgoosat mine for storage and as a result all discharge is now released to the River Bursk as it arises. As such a higher emission rate for sulphate and electrical conductivity is required.

This chapter of the EIAR will not take into consideration any other aspects of the licence outside of an increase in sulphate and electrical conductivity as all other aspects of the licence are expected to remain unchanged.

2.2 Alternative Options Considered

The Applicant has considered alternative options that would:

- Reduce the risk of failing the discharge permit at Compliance Point CP-1
- Be able to operate on the mine site, treating very significant quantities of contaminated water
- Be installed and commissioned within the shortest possible timescale, and
- The option for modular installation at the mine site.

As the EPA points out, an analysis of high-level or sectoral strategic alternatives cannot reasonably be expected within a project level EIAR. The test would be, are the alternatives discussed “reasonable” and “relevant to the proposed project and its specific characteristics”.

AECOM understands that the following main alternatives were considered by the Applicant (additional short-term measures are outlined in the SLR Drummond Mine Water Management Plan 2019 to 2020 (SLR 2019) however, the Emissions Limit Value (ELV) for sulphate may still have been exceeded by these measures and a number were discounted as outlined below):

- On site containment and controlled discharge of water containing sulphate at the mine site
- Alternative discharge point at the mine site
- On site treatment of water containing sulphate at the mine site
- Tanker water offsite
- The construction of a wetland at the mine site, and
- Release of all mine water at the existing discharge point in the River Bursk.

The information provided by the Applicant on alternatives considered is summarised below. The information is based on Drummond Mine Water Management Plan 2019 to 2020 (SLR 2019) and on Feasibility Studies prepared for the Applicant by other consultants.

No alternatives were considered for the factory site as this is physically distant to the mine site and the increase in sulphate discharge from the mine site to the River Bursk will not affect any operation at the factory site.

2.2.1 Alternative Location

2.2.1.1 Alternative Discharge Point

The potential to redirect water from the mine site via a tanker or pipe to an alternative discharge point in the River Glyde at Cormey Bridge was considered. This option would require a discharge licence and was discounted following stakeholder engagement with Inland Fisheries Ireland (IFI). IFI raised environmental concerns with discharging to this location relating to the fishery value of the stretch of river in question. Salmon spawning occurs in the upper reaches of the River Glyde as a result of the gradient, availability of suitable substrate and water quality. The stretch of river between Cormey Bridge and Tobermannan Bridge contains both spawning and nursery habitat. Downstream of Tobermannan Bridge the habitat is more suited to adult salmonids and coarse fish. As a result, this option was not considered further.

2.2.2 Alternative Technologies

2.2.2.1 On Site Treatment of Water Containing Sulphate

Electrocoagulation and reverse osmosis have been considered as possible treatment technologies. However, both were excluded due to the volume of water requiring treatment and these technologies not being optimised to said volumes.

2.2.2.1.1 Electrocoagulation

Electrocoagulation (EIC) is a broad-spectrum treatment technology involving the application of electricity to electrodes for the removal of contaminants. The technology is used for the treatment of water containing suspended solids (TSS), heavy metals, sulphate, emulsified oils, bacteria and other contaminants¹ (Nariyan, E., Sillanpaa, M., and Wolkersdorfer, C. 2017).

The system is made up of three primary components, a power supply, EIC cell housing and the EIC electrodes. As water passes through the EIC cell multiple processes occur co-currently to separate TSS, heavy metals etc. from the water.

Further analysis of this treatment option by the Applicant identified that this would be the first time this treatment process would be used to treat the volumes of water experienced at the mine site. To upscale and develop the technology and system required to operate at the levels in question and to establish whether indeed it would function at this scale would take a significant amount of time which is not available to the Applicant, and cannot be relied upon to function suitably at this scale in any case. This option was therefore not taken forward.

2.2.2.1.2 Reverse Osmosis

Reverse Osmosis (RO) is a separation technique suitable for a range of applications including the removal of dissolved substances such as sulphate from water by forcing water under pressure through a semipermeable (porous) membrane such as a thin film composite or cellulose acetate membranes². RO occurs when a pressure greater than osmotic pressure is applied to a concentrated solution, when water is forced from the concentrated to the diluted side the membranes retain solutes (Lanxess 2013). Water utilisation is required to produce clean water in the RO process.

While RO has the capability to produce a treated effluent to a sulphate concentration of 200 mg/L, the RO process would result in the production of waste concentrate requiring management and disposal throughout the operational lifetime of the mine site. A location for storage of this concentrate would be required on site. At present the only location on the mine with storage capacity is Drumgoosat Mine however following the unexpected subsidence of this mine it is unlikely this area could be used for storage of concentrate from the RO system.

On site storage (within the disused portions of the mine) and direct discharge of the concentrate during heavy flow conditions would increase the overall environmental risk (highly concentrated effluent and mine stability) and off-site disposal (tankering discussed below) of large volumes of concentrate would not be deemed practical or sustainable.

2.2.3 Alternative Project Design

2.2.3.1 Construction of a Wetland Onsite

At a very early stage in the alternatives process the Applicant gave consideration to the establishment of a constructed wetland area on the mine site to facilitate in the management of excess water. This option was discounted by the Applicant early in the alternative's considerations process as an unreasonable alternative due to limitations in available space on site.

2.2.3.2 Sprinkler System

The Applicant considered the re-use of mine water for the purpose of irrigation at the mine site through evaporation and evapotranspiration. The Applicant commissioned research by others to assess the effect of mine water on the vegetation being irrigated and on the environment. However, this option was not brought forward by the Applicant as it was deemed that the volume of water that could be used would not reduce the water levels by a sufficient level in the long term.

2.2.3.3 Tanker Water Offsite to a Licenced Facility

The potential to tanker water offsite from the mine site to a licensed receiving facility was considered. However, this would result in an increase in local traffic for the lifetime of the site. An increase in traffic in the local area could result in local impacts to air quality and climate, and noise and vibration environments. An increase in traffic could also have knock on effects on population and human health and landscape and visual environment.

¹ <https://www.watertectonics.com/electrocoagulation/>

² <https://www.wateronline.com/doc/industrial-wastewater-reverse-osmosis-0001>

In addition, this option is unlikely to be sustainable both short and long term resulting from the amount of water that would be required to be tankered off site (up to 12,240 m³ per day or 510 m³ per hour) and would be impractical over the lifetime of the mining operation.

This option was not brought forward as it would likely introduce associated additional environmental impacts such as increased traffic on the roads surrounding the mine site.

2.2.3.4 Redirect Water from the Mine Site to the Factory Site

The option of redirecting excess water from the mine site to the Factory Site was also considered. This would result in a reduction of 24m³/hr. This has been considered and implemented as a short term management measure to reduce discharge volumes at the mine site, however this option is not a reliable option as water can only be used when factory activities facilitate it and it would still result in a requirement to discharge water to the River Bursk in any case. This partial option also requires the transport of water from the mine site to the factory site which could potentially result in additional traffic (with associated environmental impacts) to and from both sites and increases in CO₂ emission etc.

This partial option is considered unreliable as water can only be diverted when factory activities facilitate it and it would not divert enough water in any case to eliminate the requirement to discharge to the River Bursk. Therefore, this option was not brought forward for consideration as a long term option.

2.2.3.5 Redirect Water from the Mine Site to a Precast Concrete Site

Consideration was given to redirecting excess water from the mine site to a precast concrete manufacturer. Concrete manufacturing requires significant volumes of water and there is a concrete manufacturing site located circa. 5 km from the mine site. While the Applicant are investigating the potential impact of mine water with high sulphate levels on concrete setting and long term product strength and practical arrangements for water storage at the concrete plant site, this option was considered unviable by the Applicant in the short term and has not been brought forward for consideration at this time.

2.2.3.6 Increase the Water Storage Capacity in the Quarry

An increase in the water storage capacity of the mine site was considered by the Applicant. While it is considered possible to add short term storage of up to c. 30,000 m³ in 2019 and increasing to 60,000 m³ in 2020 this was deemed unlikely to be of significant impact given the overall volumes of water under consideration. If this was to be implemented it could potentially provide emergency storage capacity, but it has not been considered further at this point in time.

2.2.3.7 On Site Containment and Controlled Discharge of Water Containing Sulphate

The water management procedure on the Drummond mine site includes a system for natural groundwater which has come in contact with gypsum characterised by high levels of sulphate and conductivity. There is no water used in any production or industrial process on the mine site and wastewater effluent is collected and treated separately. The water management procedure contains and controls the discharge of water containing sulphate into the River Bursk 70 m upstream of Compliance Point CP-1.

During times of restricted flow in the River Bursk (between April and September) it was not possible to discharge directly to the River Bursk as the compliance monitoring point would likely register high levels of sulphate. Where this occurred water would then be diverted to the decommissioned Drumgoosat Mine. Once flow conditions in the River Bursk allowed, release to the River Bursk resumed. The decommissioned Drumgoosat Mine provided an area for mine water storage during periods of low flow in the River Bursk which was incorporated into the overall mine water management procedure. This in effect allowed the concentration of sulphate at Compliance Point CP-1 to be managed to a limit of 200 mg/L.

It has been agreed with EPA, Monaghan County Council and Department of Communications, Climate Action and Environment (DCCA) that the storage of water in these mine workings should be avoided and as such the water management procedure at the mine site has been altered.

In addition SLR (2019b) considered the potential to increase the water storage capacity in the quarry. SLR (2019b) identified a possibility to increase the storage capacity in the quarry by constructing a bund on the quarry floor to increase existing storage however this would only provide short term storage of 30,000 m³ in 2019 increasing to 60,000 m³ by 2020. It was deemed the amount of water storage this would facilitate *"would not make a significant impact given the overall volumes of water under consideration"* and it could only provide emergency storage capacity (SLR 2019b).

2.2.4 Alternative Processes

2.2.4.1 Reduce the dewatering rate of Drumgoosat Mine

The Applicant has proposed to reduce the pumping rate (to 10 m³/hr) from Drumgoosat Mine to a level where the water level in the mine is maintained but not allowed to increase. SLR (2019) identified it may be possible to temporarily reduce pumped discharge rates during periods when overall discharge from the site needed to be reduced. This option would only be a short term option to reduce discharge volumes but would not provide a long term solution.

2.2.4.2 Release of all Mine Water at the Existing Discharge Point in the River Bursk

This option involves the direct release of mine water to the Bursk River through the existing settlement lagoons located on the mine site. This will include the continuation of monitoring in line with the existing IEL which states: *"The licensee shall maintain to the satisfaction of the Agency a quality control system to ensure that the empirical relationship established between conductivity and sulphate levels in water is valid on an on-going basis. The quality control system shall include a response programme for exceedances of warning and action limits"*.

The Proposed Licence Amendment to increase the ELV for sulphate to 1,250 mg/L and electrical conductivity to 2,360 µS/cm facilitates exceptional and emergency flows, the typical operating levels at the mine site are below the 1,250 mg/L limit. This option has been considered following review of the extensive data provided by the Applicant of additional monitoring undertaken between October 2018 and October 2019.

A review of the 480 readings collected down gradient of Compliance Point CP-1, including the review of a reasonable worst-case scenario, showed surface water impacts were limited to circa 2 km down gradient when direct release is occurring. The proposed direct release is therefor considered unlikely to have significant adverse impacts to the identified sensitive water receptors.

This option has been taken forward as the best available option at the mine site at this time as this option would not require the implementation of any additional infrastructure and would utilise the infrastructure already in place on site.

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3 Project Description

3.1 Introduction

This chapter provides a description of the Proposed Licence Amendment and outlines the location of the mine site and the factory site, their surroundings and characteristics of the Proposed Licence Amendment. The Proposed Licence Amendment will require an increase in the current ELV for sulphate from the current level of 200 mg/L to 1,250 mg/L as well as an increase in electrical conductivity ELV from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 (Figure 3-2) in the River Bursk. Conductivity is closely correlated to the sulphate concentration, such that lowering sulphate concentration causes lower conductivity, and raising sulphate increases conductivity. Thus regulation of sulphate concentration automatically regulates the associated conductivity. Both the mine site and the factory site are licenced under IEL P0519-03 however the review of the ELV for sulphate and electrical conductivity relates to the discharge from the mine site to the River Bursk only.

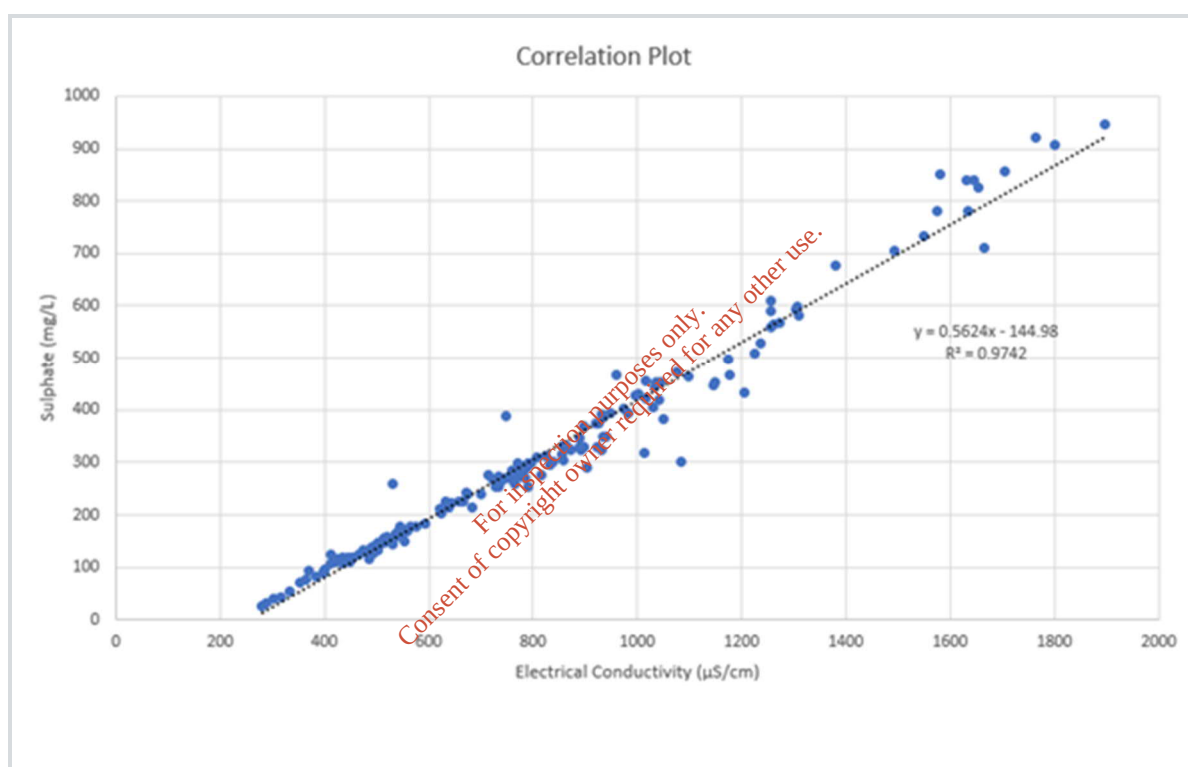


Figure 3-1 Empirical correlation based on laboratory data from samples collected at CP1 (September 2018 to September 2019)

This chapter of the EIAR will predominately focus on the aspects of the licence relating to the change in EVL for sulphate and electrical conductivity.

It should be noted that, assessments and information that form the basis of this EIAR are based on the Proposed Licence Amendment as described in this chapter.

3.2 Location

3.2.1 The Mine Site

The mine site is located in Co. Monaghan and is located in the townlands of Knocknacran, Drummond, Derrynascobe, Derrynaglah, and Enagh (Irish Transverse Mercator (ITM) co-ordinates 680971, 799586). It is bound by the R179, a regional road between Carrickmacross and Kingscourt, to the north and west and by local roads to the south and east. The mine site is accessed from a local road the L4816. Gypsum deposits have been known to be in the Kingscourt-Carrickmacross area for over a century (Golder Associates Ireland Limited 2017; Golder Associates Ireland Limited are hereafter referred to as Golder Associates). The predominant land use on the site is the existing gypsum underground mine and the open pit mine.

3.2.2 The Factory Site

The factory site, a gypsum processing site is located in in Lisnabow, Kilmainhamwood, County Meath and is located within the townlands of Lisnagrow, Ballynaclose and Raloaghan³ (ITM co-ordinates 678645, 792225). The factory site is situated circa 7 km south of the mine site and is bound by the R162 to the east, by an unnamed local road to the west, and by one-off residential dwellings and areas of greenfield to the south and north. The factory site is accessed from the R162. The factory site is positioned in a valley and a disused railway line runs through the site to the west of the capped/decommissioned landfill site (RPS 2018). The prominent land use surrounding the factory site is agricultural pasture lands (EPA 2020)⁴.

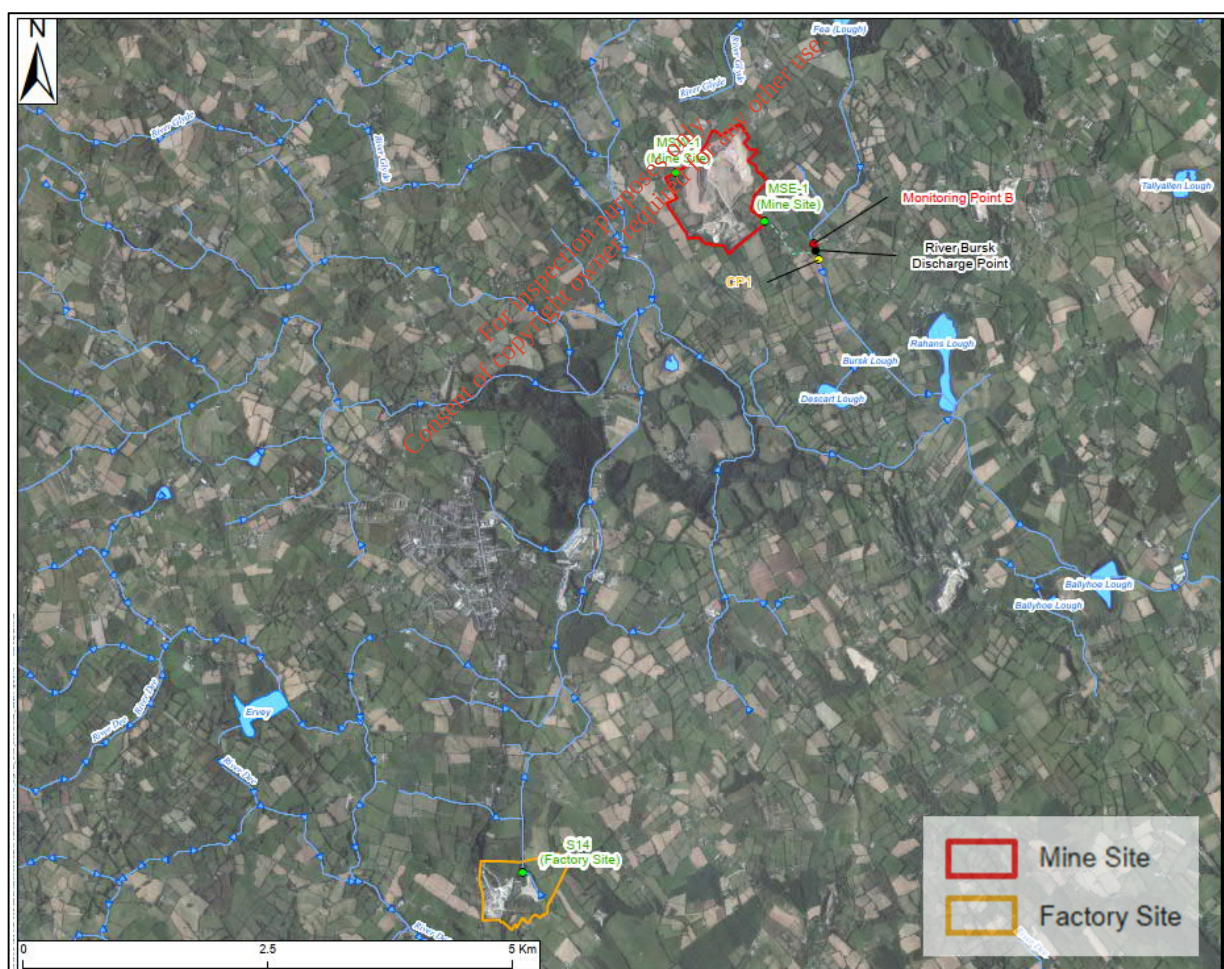


Figure 3-2 Location of the Mine Site and the Factory Site (Volume 3, Appendix A.3.1 Figure A3-1)

³ <https://www.townlands.ie/meath/carrickleck/#townlands>

⁴ Corine 2018 layer on EPA online mapper <https://gis.epa.ie/EPAMaps/>

3.2.3 Surroundings

The surrounding landscape to the mine site and the factory site is predominately agricultural fields (pastures) delineated by hedgerows and treelines, interspersed with small areas of woodland and loughs. One off residential housing and farmsteads also surround the sites. Local urban populations occur in Kingscourt and Carrickmacross.

The closest Special Area of Conservation (SAC) is Killyconny Bog (Cloghbally) SAC [site code: 000006]. This SAC is 13.2 km south-west of the factory site, but is more than 15 km from the mine site. It is in the Boyne WFD Catchment (catchment ID: 07), which is a different one to the factory site and mine site, therefore there is considered to be no connectivity to this SAC.

The closest Special Protection Area (SPA) is Stabannan-Braganstown SPA [site code: 004091]. There is direct hydrological connectivity from the mine site and factory site to this SPA via the River Bursk and hence the River Glyde. The River Glyde runs along part of the north edge of this SPA, 27.5 km downstream from the mine site.

The closest Natural Heritage Areas (NHA) is the proposed NHA Ballyhoe Lough pNHA [site code: 001594]. There is direct hydrological connectivity from the mine site and factory site, with the River Glyde entering Ballyhoe Lough approximately 4.5 km downstream of the mine discharge.

The mine site is located within the Glyde_SC_010 sub-catchment. The River Bursk (Glyde_30) waterbody is situated to the east of the mine site. The Glyde_30 river body is classed not at risk directly up and downgradient of the site. The online EPA map viewer recorded the nearest ecological monitoring point approximately 6 km downstream of the site, with a Q value Score of 4. The river water quality status 2013-2018_ is listed as good. Glyde_030 is classed as a drinking water river (IE_NB_06GO20400), protected area code: IEPA1_NB_06GO20400.

The factory site is located within the Glyde_010 and Dee_010 sub-catchments. Glyde_010 is 51 km in length with a southern tributary originating within the factory site. The Glyde_010 river body is classed as 'not at risk'. There are no up or down stream Q values within the Glyde_010, the nearest recorded Q value is at Glyde_020 with a Score of 4. The river water quality status 2013-2018 is listed as good. It is not listed as a drinking water river.

The Dee_020 river water body is circa 400 m south of the factory site. Due to the close proximity of the factory site to Glyde_010 and engineered onsite discharge systems leading to the EPA emission point S14. The factory site water is not considered to discharge to the 020 Dee water body.

The existing Compliance Point CP-1 to which the Proposed Licence Amendment relates is located circa 70 m downstream of the mine site discharge point to the River Bursk (Figure 3-2). A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the mine compliance point.

3.3 Historical and Current Activities

3.3.1 Historical Activities

3.3.1.1 The Mine Site

Gypsum deposits have been known to be in the Kingscourt-Carrickmacross area for over a century. Gypsum deposited within the Kingscourt formation has been subject to historical mining in the region as far back as 1871 (Golder Associates 2017). The mine site was opened by Gypsum and Bricks Limited which is now Saint-Gobain Mining (Ireland) Limited in 1936. Gypsum was initially produced from the Ballynaclose open-pit mine, and the Lisnabow underground mine. Mining at these locations was succeeded by an underground mine at Drumgill in 1943. Increasing demand for product lead to the opening of additional mines at Cormey (1952 to 1961) and Drumgoosat (from 1958 to 1989). The Drumgoosat underground mine is located to the north / northwest of Knocknacran Quarry. Drummond Underground mine has been operational from 2006 to 2008 and from 2013 (Piteau Associates 2020) to present.

Knocknacran open cast mine is the centre of the mining area, the mine is currently circa 70 m deep with an aerial extent of circa 55 ha. Sump pumping rates from the mine are not recorded but are estimated to range seasonally between circa 10 m³/d in September (groundwater flow) and 950 m³/day in April (mostly surface flow) (Piteau Associates 2020).

Drummond underground mine is reported to extend circa 155 mbgl depth with an aerial extent of circa 38 ha. Inflows to the mine have been reported to historically be between 1,400 and 2,200 m³/d, however an increase was

observed in June 2018 when mine works intersected a fault. Following which inflows were reported to initially be circa 12,000 m³/d but have since reduced to circa 1,200 m³/d (Piteau Associates 2020).

Drumgoosat underground mine is reported to be circa 100 mbgl depth with an aerial extent of circa 80 ha. The mine was temporally used to store excess water from the Drummond underground mine (Piteau Associates 2020) and during times of low flow at the River Bursk when the release of water could potentially lead to a noncompliance event, this occurred up until September 2019.

The Applicants open-pit mine at Knocknacran has been in operation since 1989 following granted planning permission in 1984 and 1985 (Planning Reference Number 83/461 and PL 18/5/67892). An extension to the mine was granted in 2007 under planning permission Number 07/430 (Golder Associates 2017). In 2004 planning permission was sought by the Applicant for the underground extraction of gypsum at Drummond underground mine across an area of circa 114 ha which incorporated an upper and lower gypsum seam (Golder Associates 2017; Monaghan County Council planning ref. 07430). Further planning permission was granted by Monaghan County council in 2017 for the continued extraction of gypsum from the open pit mine (Golder Associates 2017). This also included the phased restoration of the open pit mine (Monaghan County Council planning ref 17217). The mine site produces between 300, 000 and 500, 000 tonnes of gypsum per year. Activities at the mine site have been subject to an IPC licence since 2002.

Discharge water from the Applicants mining areas has been discharged to the River Bursk for circa 30 years.

3.3.1.2 The Factory Site

A capped / decommissioned landfill is located on the factory site. Gypsum Industries have operated the landfill at the factory site since 1936 with official records of waste deposited beginning in 1970. The capped landfill was used for the disposal of waste plaster and plasterboard, construction and demolition waste, wooden pallets, plastics and domestic type waste. Landfilling at the factory site ceased on the 17th of July 2009 and landfill capping construction works began in 2017 and were completed by 2018 (RPS 2018). The landfill is located to the east of the factory plant and is accessed through the factory site.

Since the 1980's recovered gypsum has been stored in the storage building granted planning permission under planning reference number 80/1231. The gypsum waste material is stored on a concrete surface prior to gypsum processing. Recycled material is used in the production process or as a soil conditioner for agriculture (RPS 2018).

The RPS Landfill Closure, Restoration and Aftercare Management Plan (CRAMP) 2018 update suggests that historical gypsum facilities at the factory site such as the landfill were exempt from planning permission as they pre-dated the relevant planning legislation. Resulting from this there is limited information available on the factory site. A list of known planning permission relating to the factory site is included in previous correspondence from the Applicant to the EPA dated 11th June 2012 in relation to a previous licence review.

3.3.2 Current Activities

3.3.2.1 The Mine Site

The mine site comprises an open pit gypsum mine, underground gypsum mine, settlement lagoons, processing plant including crushers and homogenisers, non-extraction areas, administration buildings and a car park (KD Environmental 2019). Facilities at the mine site include crushing plant, lorry loading facilities, a workshop, storage silos, office buildings and a water lagoon system. A transformer sub-station is also located at the mine site. The produce from the site supplies a plasterboard factory owned and operated by Saint-Gobain referred to in this document as the factory site.

The processes at the opencast mine include the following activities (Gyproc 2018):

- The removal of topsoil, subsoil, and overburden to expose the gypsum rock by hydraulic excavators and dump trucks
- The material which has been removed to expose the gypsum is stored on the site and the gypsum is then extracted in a series of benches
- Primary breaking is achieved by blasting and rock breakers are used to carry out secondary breaking, if required
- The broken gypsum rock is loaded onto dump trucks using a hydraulic excavator and transported to the surface primary crusher which reduces the run-of-mine rock to less than 300 mm. The minus 300 mm rock is transported by conveyor belt to a vibrating grizzly feeder. Material less than 75 mm passes through the feeder

and the oversize is directed to the secondary crusher. The secondary crusher reduces the oversize material to less than 75 mm

- The rock is then transported by conveyor belt to the stacker-reclaimer (homogenizer) where it is stored under cover awaiting collection either to the plaster and plasterboard factory near Kingscourt or to cement manufacturing companies, and
- Once the entire gypsum mineral has been removed from an area, the area is backfilled using the stored topsoil, subsoil, and overburden

The processes at the underground mine include the following activities (Gyproc 2018):

- Gypsum rock is drilled and blasted from a series of tunnels
- The tunnels are laid out in a grid pattern to form rooms (where the gypsum has been removed) and pillars (where the gypsum has been left in place)
- The rock is loaded onto dump trucks using rubber-tired loaders and transported to the underground primary crusher. The underground primary crusher reduces the run-of-mine rock to less than 300 mm
- This material is then transported to surface on a conveyor belt, where it joins the surface processing plant at the secondary crusher, and
- All mining operations are carried out within the confines of the gypsum deposit therefore no waste material is extracted. This eliminates the need for spoil heaps or dumps.

3.3.2.2 The Factory Site

The extracted gypsum from the mine site is transported to the factory site where it is processed into gypsum plaster and plasterboard. The factory site includes office space, storage silos, warehouses, workshops, capped/decommissioned landfill and a water lagoon system (KD Environmental 2018), a waste plasterboard recycling installation licenced to accept up to 18,000 tonnes of recycled plasterboard (List of Waste (LoW) Code 17 08 02) per year under IEL P0519-03, and four settlement lagoons.

The gypsum is mined above and below ground at the mine site and is transported by road to the factory site where it is converted to gypsum plaster boards, cement or builders' plaster. The main operation at the factory site is the processing of gypsum into plasterboard and building plaster for use by the construction industry. All manufacturing activities occur indoors (KD Environmental 2018).

The processes at the factory site include the following activities (Gyproc 2018):

- The processing of the mineral gypsum into plasterboard and building plaster for use in the construction industry. This involves calcination of the gypsum mineral.
- The mineral gypsum is initially crushed to produce a fine powder and heated to remove some of its water content. This forms the product 'Plaster of Paris'.
- This is further crushed to a particle size of 150 µm before being calcinated at 140 to 170°C which converts the gypsum to hemihydrate known commonly as stucco. This stucco material is the raw material of building plaster and plasterboard.
- In producing building plaster, process chemicals are added to the stucco to prevent the product from rehydrating too quickly when rehydrated or mixed with water resulting in a longer setting duration.
- For Plasterboard, the calcinated stucco is mixed with starch, water and air entraining agents to give a fluid consistency. This is then spread onto large sheets of paper and covered with a second sheet of paper to form a plaster sandwich plasterboard. The plasterboard is dried using a 3 stage gas fired dryer, and.
- Plasterboard sheets are then trimmed and cut to desired length.

3.3.3 Existing Industrial Emissions Licence (IEL)

As previously mentioned, an IEL has been granted for operations at the site, P0519. This licence covers the operations and emissions from both the mine site and the factory site. The licence P0519-01, issued by the EPA in 2002 was amended in 2005 to P0519-02 and to the current licence P0519-03 in 2015. The licence outlines a number of emission limits for air at the factory site, water at both the mine and factory sites and emissions to sewer. The licence also sets noise limits and dust deposition limits for both the mine and factory sites. Control and monitoring parameters and monitoring frequency is also set out within P0519-03 for the mine and factory site where

applicable. Emissions limits are set out in schedule B of the licence while control and monitoring parameters and monitoring frequencies are set out in Schedule C of the licence. The results of this monitoring are to be submitted as required by the licence. The licence also requires an annual biological impact assessment relating to surface water discharges from the installation; this is reported within the Annual Environmental Report which is submitted to the EPA.

This existing IEL includes a sulphate compliance limit of 200 mg/L and electrical conductivity of 1000 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1.

3.3.4 Surface Water Courses and Water Sources

Both the mine site and the factory site are licenced under IEL P0519-03 however this Proposed Licence Amendment relates to the discharge from the mine site to the River Bursk only. As the Proposed Licence Amendment relates to discharge to surface water, information on watercourses, sources of water and site discharge for both the mine site and the factory site are provided below.

3.3.4.1 The Mine Site

There are three primary local surface water courses near the mine site, as follows:

- Magheracloone Stream. Running north to south along the western boundary of the site
- River Bursk (also known as River Lurgans and the river Rahans). Running along the eastern boundary of the site and receiving water from MSW-1, and
- River Lagan (also known as the River Glyde). Receives water from both the Magheracloone and Bursk flows from west to east to the south of the site.

The mine site and aforementioned rivers fall within the Water Framework Directive (WFD) 06 - Newry, Fane, Glyde and Dee catchment and sub catchment 06_7 (Glyde_SC_010).

Discharge water from the Applicants mining areas has been discharged to the River Bursk for circa 30 years. Over the 30 year period the River Bursk was known to experience low flows between April and September (SLR 2019). The River Bursk flows into Bursk Lough to Rahans Lough and then to the River Lagan.

3.3.4.1.1 Water Sources at the Mine Site

Water sources include groundwater inflow from the underground mine, direct rainfall water from the open pit mine and site surface water from the areas surrounding the mine site.

There are three principal water sources at the mine site, these are:

- Drummond Mine (underground gypsum mine works)
- Knocknacran Quarry (open pit gypsum mine), and
- Drumgoosat Mine (decommissioned underground gypsum mine, previously used for water storage).

All inflow sources at the (active) Drummond mine site are reported to derive from groundwater. Current flows are estimated at circa 2,000 m^3/d and circa 50% is thought to be derived from the fault encountered in 2018 (Piteau Associates 2020). The remainder of the flow is said to derive from joints and fracture zones (Piteau Associates 2020). Groundwater inflow to the mine is routes via a central sump from where it is pumped to the settlement lagoons. A bulk head was installed following the inflow of water to the mine from a fault in 2018. Water from this bulkhead is also routed to the central sump (Piteau Associates 2020).

Inflows from Knocknacran open cast mine are derived from incident precipitation and a minor amount from groundwater inflow. The water is then collected in a sump on the pit floor and pumped into the settlement lagoons (Piteau Associates 2020).

Inflows to Drumgoosat underground mine are derived from groundwater and previously included water pumped into the mine as part of the site water management strategy. Pumping into Drumgoosat underground mine has since ceased. Water from Drumgoosat underground mine is pumped from a borehole in the old mine to the settlement lagoons (Piteau Associates 2020).

Water from the sources outlined above is pumped to the settlement lagoons at the mine site. Settlement of suspended solids occurs at the settlement lagoons. Surface water runoff from areas around the above ground infrastructure at the mine site including the workshop, office and car park is also directed to the settlement lagoons

(Piteau Associates 2020). Surface water runoff from the workshop hardstanding is directed to a hydrocarbon separator prior to pumping into the settlement lagoons (Piteau Associates 2020). The surface water volumes are considered to be small when compared to the volume of water from the other mining areas (Piteau Associates 2020).

Water from the settlement lagoons is then pumped to the River Bursk via the infrastructure at MSE-1 located in the south eastern corner of the site. Two large holding tanks, a v-notch weir for measuring discharge flow and continuous monitoring instrumentation for measurement of electrical conductivity (to facilitate the measurement of sulphate) are located at MSE-1 (Figure 3-2) (Piteau Associates 2020). It is understood continuous monitoring will continue in line with the IEL requirements. The licence states that a maximum of 12,240 m³/day can be discharged at MSE-1.

The mine water discharge from the mine site comprises natural groundwater which has come in contact with gypsum mineral underground. The water released to the stream is not subject to industrial use; the water is being collected from the underground workings or the quarry pit and discharged. There is no process water used at the site which would require treatment.

3.3.4.1.2 Existing Water Quality Monitoring Regime

Chemical water quality testing has been carried out in the River Bursk downstream of Compliance Point CP-1 as far as Tallanstown. Biological water quality monitoring also occurs downstream of the discharge point in the River Bursk. Water Quality monitoring on site is as per the requirements of the current licence P0519-03.

3.3.4.2 The Factory Site

There are two primary local surface water courses near the factory site, as follows:

- Drainage channel (EPA name: Ballynaclose, IE_NB_06G020070). Running north along the historical railway prior to meeting the River Lagan, and
- Dee River (EPA name: Dee, IE_NB_06D010035). Running west to east along south of the site.

The factory site falls within the WFD 06 - Newry, Fane, Glyde and Dee catchment and sub catchment 06_7 (Glyde_SC_010).

3.3.4.2.1 Water Sources on Site

All surface water runoff from the capped landfill is directed to the stream at the north of the landfill. A leachate interceptor drain has been installed around the perimeter of the landfill, the leachate is directed to lagoons to the north of the factory site (RPS 2018). Leachate from the landfill enters an interceptor drain the leachate drain is capped over isolating the landfill leachate from clean surface water and rainfall (RPS 2018).

The Landfill Closure, Restoration and Aftercare Management Plan (CRAMP) 2018 Update, identified four lagoons on site for the treatment of leachate from the landfill (RPS 2018). The lagoons currently receive:

- Surface water run-off from the factory
- Leachate from the landfill, and
- Clean surface water run-off from the western portion of the landfill.

Surface water from the gypsum storage area at the factory site drains to a storage lagoon where it is either reused in the gypsum process or tested prior to release to the associated water body in accordance with the existing IEL (BioCore Environmental 2012).

3.3.4.2.2 Existing Water Quality Monitoring Regime

Water Quality monitoring on site is as per the requirements of the current licence P0519-03.

3.3.5 Site Discharge and Emissions

Both the mine site and the factory site are licenced under IEL P0519-03 however the review of the compliance limit value for sulphate and electrical conductivity relates to the discharge from the mine site to the River Bursk only.

3.3.5.1 The Mine Site

The emission and monitoring points covered under IEL P0519-03 are MSE-1 at the River Bursk, Compliance Point 'CP-1' (grid reference: 282041E 298746N) 70 m downstream of discharge to River Bursk, and 'Mine Site B' (grid reference: 281991E 298912N) upstream of 'MSE-1'. Groundwater monitoring also occurs at the mine site. The parameters monitored and the frequency of monitoring are set out in IEL P0519-03.

Discharge from the mine site is discharged into the River Bursk (Glyde_30) at emissions point MSE-1 (Grid Reference: 281489E 299140N). Discharge water from MSE 1 flows through a culvert towards the south of the site and outfalls to the Glyde_30 approximately 680 m from the mine site. Downstream of the discharge point the river (River Bursk) flows southeast adjoining Descart Lough and Rahans Lough. Discharge water from MSW-1 flows through a ditch east along the site boundary before it eventually joins the Glyde_020 (River Lagan) northwest of the mine site. It is noted that this discharge is planned to be discontinued. The discharged water is managed in line with the current IEL P0519-03.

The water management procedure on site consisted of two systems, one for water which had come in contact with gypsum and a separate system for water that has not been in contact with gypsum. Water that has come in contact with gypsum is characterised by elevated levels of sulphate (BioCore Environmental 2012). Water which has come in contact with gypsum is managed in line with the current IEL P0519-03 and consists of natural groundwater which has come in contact with gypsum mineral underground and does not include process water or effluent (SLR 2019).

Over the 30 year period of discharge to the River Bursk it was observed to experience low flows during the summer period, between April and September (SLR 2019). During these times it was not possible to discharge directly to the River Bursk as the compliance monitoring point would register high levels of sulphate. Water would then be diverted to the decommissioned Drumgoosat Mine. Once flow conditions in the River Bursk allowed, release to the River Bursk resumed (SLR 2019). The decommissioned Drumgoosat Mine provided an area for mine water storage during periods of low flow in the River Bursk that could be incorporated into the overall mine water management procedure.

A number of additional emissions limits and monitoring requirements for the mine site are licenced under the current IEL P0519-03 including emissions to sewer, noise limits, and dust deposition limits. The parameters monitored and the frequency of monitoring are set out in IEL P0519-03.

3.3.5.2 The Factory Site

Discharge water from the factory site is discharged into the Ballynaclose (Glyde_10) waterbody at emissions point S14 (grid reference: 279012E 292474N; see Figure 3-2). The discharged water is managed in line with the current IEL P0519-03. Additional monitoring locations include S5 (Grid reference: 279109E 292084N) upstream of S14 and S3 (Grid reference: 279015E 292642N) downstream of S14, S1 (grid reference: 27861E 29215N) and S2 (grid reference: 27911E 29207N). A number of additional emissions limits and monitoring requirements for the factory site are licenced under the current IEL P0519-03 including emissions to air (monitoring at emissions points AE-1, AE-8, AE-9, AE-10, BE-1, BE-4, BE-5, BE-6) emissions to sewer, noise limits, and dust deposition limits. Groundwater monitoring also occurs at the factory site. The parameters monitored and the frequency of monitoring are set out in IEL P0519-03.

The factory site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite to avoid potential contamination. As part of the licence requirements the factory site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three-year basis with frequent visual inspections.

A number of additional emissions limits and monitoring requirements for the factory site are licenced under the current IEL P0519-03 including emissions to sewer, noise limits, and dust deposition limits. The parameters monitored and the frequency of monitoring are set out in IEL P0519-03.

3.4 Characteristics of the Proposed Licence Amendment

As part of the previous water management procedure at the mine site, water from the Drummond mine was temporarily diverted to the decommissioned Drumgoosat mine for storage during summer months for temporary storage and balancing (SLR 2019). This water was then released to the River Bursk when flow conditions facilitated dilution at the downstream Compliance Point CP-1. This in effect allowed the concentration of sulphate at Compliance Point CP-1 to be managed to a limit of 200 mg/L. The mine water is discharged under IEL P0519-03 which has set a compliance limit of 200 mg/L for sulphate at Compliance Point CP-1.

Following the unexpected ingress of water into Drummond mine in June 2018 and the subsidence of the decommissioned Drumgoosat mine in September 2018, it was decided water could no longer be diverted to the decommissioned Drumgoosat mine for storage (SLR 2019). It is AECOMs understanding that as a result, all discharge is now directly off site to the existing discharge point on the River Bursk (SLR 2019) via existing

settlement lagoons. As the capacity of the River Bursk to dilute sulphate is reduced during periods of low flow, this can result in higher concentrations of sulphate at Compliance Point CP-1 at certain times of year.

In light of the above the Applicant is seeking a review of IEL P0519-03. A review is required due to a change in the water management procedure at the mine site and seeks to obtain an increased ELV for sulphate from 200 mg/L to 1,250 mg/L and an increase in the ELV for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1. While the IEL issued by the Environmental Protection Agency (EPA) covers both the mining and the factory site the IEL review only looks to obtain an increased ELV for sulphate and electrical conductivity at Compliance Point CP-1 for the mining operation. No additional traffic will be required to arrive or depart either the mine site or factory site, there will be no change to working hours on either site, no additional parking, no additional infrastructure or updates to existing infrastructure will be required. .

The mine water discharge from the mine site comprises mainly natural groundwater and a small proportion of surface water run-off which has come in contact with gypsum mineral underground. The existing discharge point has been in use by the Applicant for circa 30 years. Monitoring occurs in line with IEL P0519-03 and EPA requirements.

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4 Traffic and Transport

4.1 Introduction

This chapter considers the contents of a Traffic and Transport assessment (TTA) which was completed by PMCE on behalf of Golder Associates in 2017 in order to identify potential traffic related impacts associated with the proposed time extension of operations at the existing mine site. The TTA was updated in 2019, where a review of the traffic impacts associated with potential future development was undertaken.

Both assessments examined the traffic implications associated with the potential future development in terms of its integration with existing traffic in the area. The assessments also determined and quantified the extent of trips generated by the development, and the impact on operational performance of such trips on the local road network.

The Proposed Licence Amendment does not intend to increase any throughput in traffic; therefore, it was determined that a detailed Traffic and Transport Assessment (TTA) was not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter. This chapter provides a summary only of the baseline environment for the study area.

This chapter should be read in conjunction with Chapter 3 Project Description.

4.2 Methodology

4.2.1 Sources of Information

In preparing this report reference has been made to the following documents provided by the client:

- Time Extension for Operations at Existing Gypsum Mine, Knocknacran, Co. Monaghan, Traffic and Transport Assessment (PMCE, 2017)
- Potential future development, Traffic and Transport Assessment (PMCE, 2019), and
- EPA's draft 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'.

An EIA was previously prepared by Golder Associates to support an application made by the Applicant in 2017 to Monaghan County Council in order to continue mining operations under IEL P0519-03. The EIA included a traffic and transport chapter. The EIAR noted that the link roads to the north and south of the mine site would continue to operate within capacity for each of the assessment years of 2018, 2023 and 2033.

4.2.2 Legislation and Guidance

The following relevant policy and legislation has informed the scope for the impact assessment.

Table 4-1 Legislation and Guidance

Legislation	Year	Description of why the Legislative Policy and Guidance is of Relevance
Legislation		
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU	2014	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed in an EIAR, this includes material assets ⁵
S.I. No. 296 of 2018, European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	2018	Directive 2014/52/EU is transposed into Irish Law under S.I. No 296. The Regulations describes the EIA process and lists material assets as a factor to be contained in an EIAR.

⁵ For this assessment the Traffic and Transport assessment has been included under the term 'material assets'

Legislation	Year	Description of why the Legislative Policy and Guidance is of Relevance
Guidance		
Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA)	2017	The Draft Guidance outlines roads and traffic should be included as an environmental topic considered in an EIAR.

4.2.3 Study Area

The study area for the baseline desktop assessment focused on the access roads to existing mine site and factory site and the surrounding road network.

4.2.4 Determination of the Baseline Environment

A desktop assessment of client provided, and publicly available information was undertaken to determine the baseline environment within the study area. Information included the existing TTA's undertaken by PMCE in 2017 and 2019.

As part of the TTA's previously carried out, traffic turning count surveys were commissioned at the mine site, with the objective of providing background information relating to existing traffic movement patterns across the local road network.

No TTA was carried out at the factory site as no applications that required a traffic assessment have been submitted in recent years.

4.2.5 Significance / Evaluation Criteria

As the Proposed License Amendment does not intend to increase any throughput in traffic at either the mine or factory site, it has been determined a detailed TTA is not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

4.2.6 Limitations in the Methodology and Gaps in Information

This chapter is based on traffic data generated for Golder Associates in 2017 and by the Applicant for an EIAR in connection with the mine site. It was not deemed necessary that revised traffic count surveys were required for the Proposed Licence Amendment as there will be no additional traffic generated by the Proposed Licence Amendment.

For the purpose of this study, it has been assumed that the information obtained from the above sources are reliable and representative of the road and traffic conditions of the study area.

Limited data was available for the factory site as there was no requirement to carry out an EIAR or TTA for the Proposed Licence Amendment.

4.3 Description of the Existing Environment & Baseline Information

4.3.1 Mine Site

The mine site currently consists of an opencast mine which operates on a six-day week basis. General opening hours within the mine site is normally from 08:00am to 08:00pm. These hours include production from the pit and also overburden stripping. The adjacent underground Drummond mine operates on a two-shift basis, 6 days per week. Shift timings are up to 10 hours each. However some works can occur outside of these hours such as where maintenance is required. Truck movements to and from the site normally take place between the hours of 05:00am and midnight. This situation will continue under the proposed licensed review conditions.

Access to the mine site is provided directly from the L4816 Local Road. The L4816 extends from its junction with the R179 national road in the north and continues southwards past the mine access.

4.3.1.1 Existing Road Network

4.3.1.1.1 Regional Road Network

The R179 Regional Road runs in an east to west direction. The R179 is approximately 10 m wide with hard strips on both sides of the carriageway (Volume 3, Appendix A.4.1 Figure A4.1). The pavement within the westbound hard strip is particularly poor to the immediate east of the R179/L4816 junction.

There is a continuous centreline on the R179 and edge of carriageway road markings on both sides, although these are faded in places. The horizontal alignment of the R179 to the east is relatively straight however there is a horizontal curve in the alignment of the R179 approximately 100m to the west of the R179/L4816 junction. The L49014 local road forms a staggered crossroads with the R179 and the L4816 approximately 12 m to the west of the centreline on the L4816 at its junction with the R179.

4.3.1.1.2 Local Road Network

L4816

The mine site is accessed from the L4816 Local Road. The L4816 is approximately 9.0 m wide with no hard shoulder or hard strip at the edge of the carriageway. The L4816 runs in a north-easterly to south-westerly direction and has a relatively straight horizontal alignment. The access to the mine is gated. There are no designated pedestrian or cyclist facilities on the L4816. The cross-section of the L4816 to the north of the site access is very wide which narrows gradually towards the south of the access. There are approximately 6no. residential properties on the L4816 in the vicinity of the site access. The L4816 terminates approximately 630 m to the north at its junction with the R179 Regional Road. The road markings at the junction mouth are faded and the pavement has deteriorated on the entry radius of the junction. The junction is under 'Yield' control with traffic exiting the L4816 giving way to traffic on the R179.

L49014

The L49014 local road runs in a north to south direction terminating at its junction with the R179 Regional Road. The L49014 is approximately 3.0 m wide with no hard strips or hard shoulders at the edge of the carriageway. The pavement on the L49014 has deteriorated and is in a poor condition. The road markings at its junction with the R179 have faded. The junction is under 'Yield' control with traffic exiting the L49014 giving way to traffic on the R179.

L4900

The mine site is bounded to the east by the L4900 local road which is approximately 6.0 m wide with no hard shoulder or hard strip at the edge of the carriageway at its junction with the R179. The L4900 runs in a north-westerly to south-easterly direction continuing through the town lands of Drumgoosat and Tonaneave.

L8830

The L8830 Local Road is located to the east of the existing mine site and runs in a north to south direction terminating at its junction with the R179 Regional Road. The L8830 is approximately 7.0 m wide with no hard strips or hard shoulders at the edge of the carriageway at its junctions with the R179.

4.3.1.2 Traffic Volumes

Traffic counts (12-Hour classified counts) were carried out by PMCE on Tuesday 10th of September 2019 at three junctions, including the existing mine access, the R179/L4816/L49014 Crossroads and the R179/L4900/L8830 Staggered Crossroads, to inform the 2019 TTA.

The count was carried out between 7:00am and 7:00pm, this time period encompassing the main operating hours of the mine. The time period also includes the peak hours on the adjacent Regional and County Roads.

The traffic count data for each site was converted to Annual Average Daily Traffic (AADT) values using the methodology described in "Expansion Factors for Short Period Traffic Counts" (Unit 16.2 NRA Project Appraisal Guidelines, August 2012). See Tables 4-2 to Table 4-2 for traffic AADT values for each junction.

Table 4-2 AADT At Junction 1 - Existing Mine Access

Hour Ending	L4186 (N)	Mine Access	L4816 (S)
08:00	72	57	21
09:00	41	23	22
10:00	31	17	16
11:00	30	19	13
12:00	38	22	16
13:00	32	18	16
14:00	31	14	21
15:00	48	16	32
16:00	48	14	34
17:00	30	10	20
18:00	47	17	30
19:00	44	20	267
Period Total	492	247	508
Period Total HGVs	101	27	74
% HGVs	20.5%	10.9%	14.6%
Total AADT	622	312	338

Source: Traffic and Transport Assessment of a Potential Future Development (PMCE, 2019)

Table 4-3 AADT At Junction 2 - R179/L4816/L49014 Crossroads

Hour Ending	R179 (N)	L4816	R179 (S)	L9014
08:00	331	72	344	9
09:00	427	41	420	12
10:00	309	31	305	9
11:00	251	30	250	7
12:00	255	38	238	13
13:00	304	32	302	6
14:00	310	31	288	9
15:00	306	48	289	11
16:00	357	48	333	16
17:00	402	30	393	11
18:00	494	47	492	15
19:00	418	44	431	15
Period Total	4164	984	4532	133
Period Total HGVs	389	492	447	19
% HGVs	9.3%	50.0%	9.9%	14.3%
Total AADT	5,267	622	5,167	168

Source: Traffic and Transport Assessment of a Potential Future Development (PMCE, 2019)

Table 4-4 AADT At Junction 3 - R179/L4900/L8830 Staggered Crossroads

Hour Ending	R179 (N)	L8830	R179 (S)	L4900
08:00	32	331	22	32
09:00	436	23	427	46
10:00	343	38	309	92
11:00	260	21	251	34
12:00	259	22	255	32
13:00	305	23	304	24
14:00	318	28	310	38
15:00	317	32	306	47
16:00	367	34	357	66
17:00	415	30	402	37
18:00	485	48	494	37
19:00	405	42	418	27
Period Total	4227	746	4553	502
Period Total HGVs	393	373	389	22
% HGVs	9.3%	50.0%	8.5%	4.4%
Total AADT	5,347	472	5,267	635

Source: Traffic and Transport Assessment of a Potential Future Development (PMCE, 2019)

4.3.1.3 Traffic Speeds

Automatic Traffic Counts (ATC's) were conducted over 7 days to assess vehicle speeds and traffic volumes on the R179 and L4816 to inform the 2019 TTA. The ATCs were conducted between Tuesday the 10th of September and Monday the 16th of September at the following locations:

- L4816 south of the mine access
- L4816 south of the R179/L4816/L49014 Crossroads
- R179 east of the R179/L4816/L49014 Crossroads, and
- R179 west of the R179/L4816/L49014 Crossroads.

Table 4-5 Traffic Count and Speed Survey Results

ATC Location	Direction	Speed Limit	Number of Vehicles	No. of Vehicles Exceeding Speed Limit	% of Vehicles Exceeding Speed Limit	Mean Speed (km/h)	85 th ile Speed (km/h)
L4816 south of mine access	Northbound	80	1,009	1	0.1%	53.9	63.81
	Southbound	80	1,042	0	0.0%	50.9	60.71
R179 west of L4816/L49014 Junction	Eastbound	80	10,760	244	2.3%	62.8	72.09
	Westbound	80	11,888	622	5.2%	62.9	73.98
L4816 south of R179 Junction	Northbound	80	1,704	85	5.0%	60.6	73.44
	Southbound	80	1,752	8	0.3%	52.6	62.01
R179 east of L4816/L49014 Junction	Eastbound	80	11,591	1,220	10.5%	63.7	77.76
	Westbound	80	12,182	1,410	11.6%	63.1	78.03

Source: Traffic and Transport Assessment of a Potential Future Development (PMCE, 2019)

4.3.1.4 Sensitive Receptors

The TTA's carried out in 2017 and 2019 was based solely on any potential impact of traffic flows generated by the Proposed Licence Amendment on the local road network.

4.3.2 The Factory Site

Access to the factory site is provided directly from the R162 Regional Road. The factory site operates on a 24-hour basis from Monday to Sunday with maintenance generally carried out on Wednesdays.

Detailed baseline information such as traffic volumes and speeds was not available for the factory site at the time of writing. However this does not affect the consideration of potential impacts of the Proposed Licence Amendment as no changes to traffic and transport are anticipated as a result of the Proposed Licence Amendment.

4.3.2.1 Existing Road Network

4.3.2.1.1 Regional Road Network

R162

As outlined above, the factory site is accessed via the R162. The R162 is a regional road, 80 km long, running north from Navan in County Meath to Monaghan Town. It continues southwards through Ballybay before crossing into County Cavan at Shercock. It veers southwest through Kingscourt and enters County Meath, passing through Nobber. South of Nobber the N52 National secondary road joins it from the west and leaves eastwards at a staggered junction. It passes southwards through Wilkinstown, Kilberry and passes Navan Racecourse before terminating in Navan at the R147.

R164

The R164 road is a regional road in Ireland, linking Kingscourt in County Cavan to the N51 near Athboy, County Meath. This regional road is located to the east of the factory site and runs parallel to the factory site access road (R162). North to South the route starts in Kingscourt, County Cavan, where it diverges from the R162 and in 2 km crosses into County Meath. It continues southwards through Moynalty, across the Kells Blackwater river and into Kells. In Kells it joins the R147 at Carrick Street and continues through Castle Street; turns into the N52 at Cross Street; continues through Farrell Street and Bective Street before leaving the N52 and heading south along Rockfield Street. It leaves Kells south through Scurlockstown and Fordstown before terminating at the N51 3 km east of Athboy.

4.3.2.1.2 Local Road Network

L6802

The L6802 local road runs in a north to south direction, and terminates close to Kilmainham Wood, where it becomes Boynagh CI and continues in a southern direction. The road is located to the south of the factory site, where it diverges from the R162. There are no hard strips or hard shoulders located on the road at the edge of the carriageway at its junction with the R162. There are road markings at the north junction where it meets the R162.

4.3.2.2 Traffic Volumes

In terms of transfer of materials, on average, two trucks with 15 loads each go between the mine site and factory site between Monday and Friday, with a max of three trucks per week. All materials required for the manufacturing process arrive by road. These include via trucks and bulk tankers from Ireland/ Europe and further afield. On average, 8 truckloads arrive per day carrying materials for the manufacturing process.

Approximately 146 employees access site by car each day, with each car anticipated to contain on employee. Contractors also come to site on a daily basis.

All materials are transported to the site for the manufacturing process. Some require specialist transportation (e.g. bulk tankers). Multiple suppliers are involved in the supply of materials, this includes Irish suppliers as well as suppliers from Europe and outside of Europe. There are no Gyproc owned vehicles delivering orders. Roughly 93% of truck shipments are deliveries arranged with 3rd party hauliers and the balance are customer collections i.e. they have their own truck which comes here and gets loaded.

On an average day at the factory site there could be 60- 65 articulated HGVs going out, 5 goods in, 6 materials in (not rock) and 30 to 40 loads of rock in (trucks doing multiple runs Mon-Fri (sometimes Saturday)). In addition once

a week up to 120 loads of Spanish rock can be delivered within a single day. On a monthly basis there are approximately 4 to 6 loads of water tankered from the mine site to the factory site for use in factory processes.

4.3.2.3 Traffic Speeds

The national speed limits in Ireland include five different limits which apply to different road types and areas. These are outlined below⁶.

- Town and city speed limit 50 km/h
- Regional and local speed limits 80 km/h
- National road speed limit 100 km/h
- Motorway speed limit 100-120 km/h, and
- Special speed limits 30-60 km/h.

The road adjacent to the factory site is the R162. Regional roads in Ireland tend to have a speed limit of 80 km/h unless a special speed limit has been applied. As ATC's have not been conducted in the area surrounding the factory site the mean speed of cars on the roads are unknown.

4.4 Assessment of Potential Impacts

There will be no additional traffic generated as a result of the Proposed Licence Amendment; therefore, no impacts on the existing road network are anticipated.

4.5 Mitigation Measures

The Proposed Licence Amendment does not look to alter traffic and transport limits. No mitigation measures for either the mine or factory site are required.

4.6 Cumulative Impacts

There are no cumulative impacts associated with the mine and factory site.

4.7 Residual Impacts

There are no residual impacts associated with the mine and factory site.

4.8 Summary

The Proposed Licence Amendment does not intend to increase any throughput in traffic; therefore, it was determined that a detailed TTA was not required.

⁶ https://www.citizensinformation.ie/en/travel_and_recreation/roads_and_safety/road_traffic_speed_limits_in_ireland.html

5 Population and Human Health

5.1 Introduction

This chapter describes the potential effects of the Proposed Licence Amendment on population and human health. It defines the study area, the methodology used for developing the baseline and impact assessment, provides a description of the baseline environment in relation to population and human health and presents the findings of the impact assessment.

Impacts on population and human health have potential to arise from various aspects of the Proposed Licence Amendment. The following chapter provides an assessment of impacts on:

- Land uses and local community (effects on uses of a site through amenity impacts or loss of land)
- Economic activity and employment
- Severance, and
- Human health and well-being.

Many of the potential population and human health effects of the Proposed Licence Amendment could arise from air quality, noise, visual and traffic effects, all of which are dealt with fully in the corresponding EIAR chapters; Chapter 4 Roads & Traffic, Chapter 9 Air Quality and Chapter 10 Climate, Chapter 11 Noise and Vibration, and Chapter 12 Landscape & Visual.

5.2 Methodology

5.2.1 Sources of Information

The following legislation and guidance were reviewed and considered for this chapter:

- Primary data sources including that available from the Central Statistical Office (CSO) relating to the 2016 census
- Spatial information relevant to planning applications and decisions in Ireland from MyPlan.ie and An Bord Pleanála
- A review of relevant local policy documents for County Monaghan including the Monaghan Local Economic & Community Plan 2015- 2021 (MoCC 2015) and Healthy Monaghan Plan 2019-2022 (MoCC 2019)
- A review of relevant local policy documents for County Meath including the Economic Development Strategy for County Meath 2014-2022 (MCC 2014) and Healthy Meath Plan 2019–2021 (MCC 2019), and
- A review of secondary sources including the Border Regional Authority Planning Guidelines 2010-2022 (BRA 2010) , Regional Planning Guidelines for the Greater Dublin Area 2010-2022 (RPG 2010) and the National Spatial Strategy for Ireland 2002-2020 (DoHLGH 2002).

5.2.2 Legislation and Guidance

The following relevant policy and legislation has informed the impact assessment:

Table 5-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
EPA's draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017)	The Draft Guidance outlines environmental factors to be included in and EIAR which includes population and human health. The guidance also outlines the process to follow when carrying out an impact assessment as part of an EIAR. The terminology used within this chapter to describe the sensitivity of the receptor is as per the EPA draft guideline 2017. Effects on land use, severance and employment are

Legislative Policy and Guidance Description of why the Legislative Policy and Guidance is of Relevance

	described using the criteria provided in the guidance. Overall significance of impact will be derived as per this guideline.
National Health Service (NHS) 'HUDU Planning for Health, Rapid Health Impact Assessment Tool Fourth Edition 2019' (NHS, 2019)	The impacts of the Proposed Licence Amendment on human health will be assessed qualitatively using the health and well-being determinants set out in the HUDU guidance.

5.2.3 Determination of the Baseline Environment

The types of effects considered in the assessment of population and human health covers land use, severance, employment and human health. In order to assess the associated potential effects of the Proposed Licence Amendment, it was necessary to determine the environmental or baseline conditions, resources and receptors that currently exist at the mine and factory sites and in the surrounding area.

A baseline community profile helps to establish an in-depth understanding of the population situated within close proximity to the Proposed Licence Amendment, identifying potentially vulnerable groups. In order to gather baseline information pertaining to economic activity and employment, demographics, human health and well-being and land uses and local communities, a robust desktop study has been undertaken, drawing on information from the sources listed in Section 5.2.1. These are supplemented by professional judgement and details provided by the Applicant.

Baseline data collection for the population and human health assessment has therefore considered the communities and areas of land that encompasses the likely effects of the Proposed Licence Amendment. Baseline conditions have been collected and highlighted separately for the mine site and the factory site, this is further explained in Section 5.2.4. The impact areas for certain impacts such as human health and well-being, and local land uses, and local community have been informed by other assessments during the assessment stage of the EIAR.

At each spatial scale impacts on the resident, working and visiting populations has been assessed. Consideration has been given to the equality of impacts through the assessment of impacts on specific populations. It is also noted that the Proposed Licence Amendment will not require any construction or provision of additional infrastructure.

5.2.4 Study Area

The study area for the population and human health assessment has considered the area of land that encompasses the likely impacts of the Proposed Licence Amendment. The study area for the socio-economic appraisal covers the lands within and adjacent to the Saint Gobain mine site and factory site boundaries. The mine site is located in the electoral division of Enagh in County Monaghan. The factory site is located in the electoral division of Carrickleck in County Meath.

It should be noted, however, that there is no national guidance available on an appropriate study area to focus the assessment of population and human health. The study area has been defined with reference to the potential for impact from the Proposed Licence Amendment using professional judgement and based on availability of relevant information.

5.2.5 Determination of Sensitive Receptors

The sensitivity of the existing environment identifies the ability of the receptor to respond to potential effects. Receptors in the population and human health assessment are members of the local and wider community which have potential to be impacted by the effects described. The following section identifies the methodology for defining the sensitivity of receptors for each type of potential effect. Terminology used to describe the sensitivity of the receptor is as per the EPA guideline (EPA, 2017). The assessment of human health was assessed using London Healthy Urban Development Unit (HUDU) guidance (NHS, 2019).

5.2.5.1 Land Use and Local Community

The value and typical descriptors which have been applied to determine sensitivity to the impacts as a result of the Proposed Licence Amendment have been based on professional judgement. Examples of the sensitivities typically assigned to different land uses are identified in

Table 5-2. It is important to note, however, that other criteria are also used to inform the sensitivity of a resource to potential change. This includes how often the resource is used, how many users the resources have and whether or not the resource is maintained.

Table 5-2 Examples of Sensitivities Assigned to Different Land Uses

Sensitivity	Description
High	- Residential, commercial or industrial buildings - Buildings used by the community e.g. schools, community halls - Community land that attracts users nationally e.g. national parks - Designated public open space - Religious sites and cemeteries
Medium	- Residential, commercial or industrial land e.g. gardens - Land used by the community on a regional scale, e.g. country parks, forests and other land managed in such a way as to attract visitors from a regional catchment
Low	- Derelict or unoccupied buildings - Locally used community land e.g. local parks and playing fields

5.2.5.2 Severance

This assessment covers road network and journeys to and from the mine and factory sites. The receptors which have potential to experience severance effects are residents of the local community which use the roads in the study area to travel to commercial properties, community facilities, places of work and educational facilities. The severance assessment assesses the impacts of changes to the road network on all journeys which may be affected. No single sensitivity value was therefore assigned in the severance assessment.

5.2.5.3 Economic Activity and Employment

This assessment includes all potential direct, indirect and induced effects on the workforce at the mine and factory sites and the surrounding area. There is no consolidated methodology or practice for assessing the impact on employment in EPA guidance. The impacts of the Proposed Licence Amendment on economic activity and employment have therefore been assessed qualitatively based on potential jobs which the Proposed Licence Amendment will create. No single sensitivity value was assigned in the employment effects assessment.

5.2.5.4 Human Health and Well-being

The human health and well-being assessment includes impacts on the health of residents of properties and users of community resources in the study area. Whilst relevant guidance from the Institute of Public Health in Ireland (IPH), specifically the *Health Impact Assessment Guidance* (IPH 2009), has been considered, there is no consolidated methodology or practice for describing effects on human health in EPA guidance. The impacts of the Proposed Licence Amendment on human health was therefore assessed qualitatively using the human health determinants set out in the *London HUDU Rapid Health Impact Assessment Tool Fourth Edition 2019 (NHS, 2019)*. Whilst not designed or specifically developed for Ireland, a checklist approach provides a broad overview of the potential health impacts and is applicable to a wide range of proposals. The checklist was split into 11 broad determinants and was based on the World Health Organisation (WHO) publication 'Healthy Urban Planning' (WHO 2006).

The WHO Europe defines health as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity". Consequently, public health encompasses general wellbeing, not just the absence of illness. Some effects are direct and obvious, others are indirect, while some may be synergistic, with different types of impact acting in combination. In keeping with this definition, this assessment considers the potential impacts of the Proposed Licence Amendment on physical, mental and social health.

Factors that have the most significant influence on the health of a population are called 'determinants of health'; these include an individual's genetics and their lifestyle, the surrounding environment, as well as political, cultural and societal issues. The interrelationship between these factors is shown in Figure 5-1.

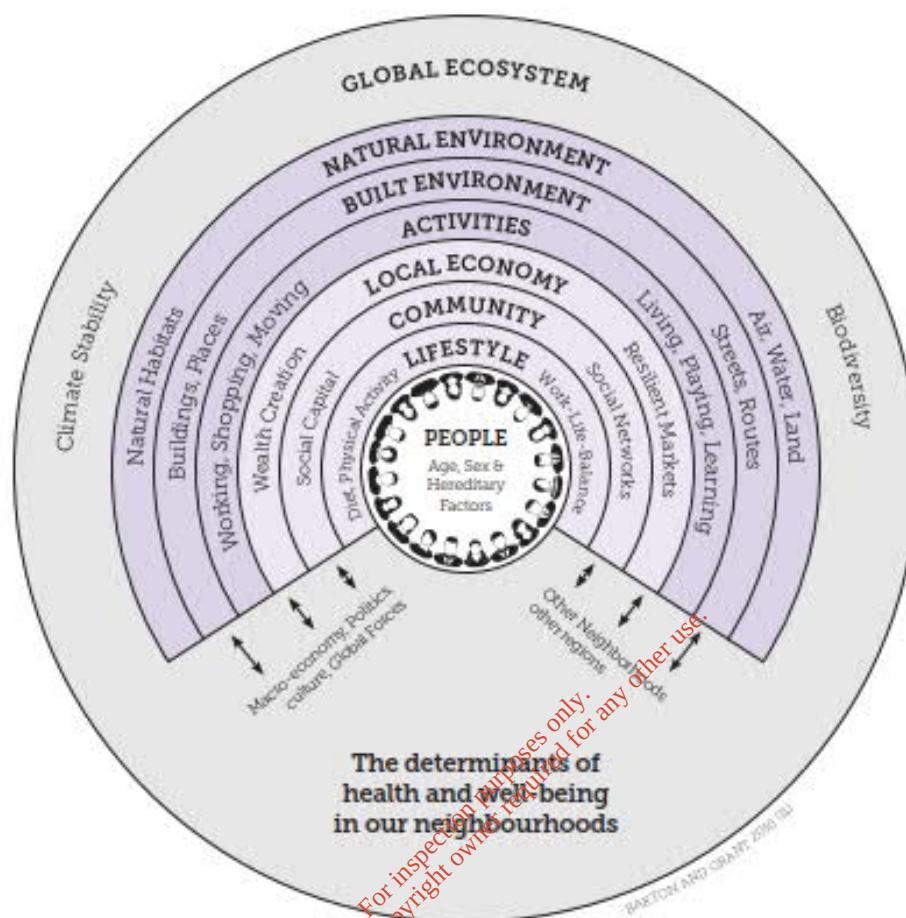


Figure 5-1: Social Determinants of Health

Source: Barton and Grant (2006)

HUDU advises that the tool is generic and should be adapted to local circumstances. This assessment of human health effects includes the likely direct, indirect and cumulative effects once the Proposed Licence Amendment is operational. Potential impacts on the health and well-being of the existing local community and residents has been considered, in particular for more vulnerable groups (such as children and the elderly). Health inequalities have also been considered. This qualitative approach does not draw on specific receptors and significance levels and does not seek to conclude the significance of impacts.

5.2.6 Significance / Evaluation Criteria

5.2.6.1 Describing Potential Effects

Effects on land use, severance and employment are described using the criteria provided in EPA guidance (EPA, 2017), and as detailed in the following sub-sections.

5.2.6.1.1 Land Use and Local Community

This assessment includes all direct and indirect effects on community resources and private assets in the study area.

The Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites. On this basis, the assessment of land use and local community is unlikely to result in a significant effect.

5.2.6.1.2 Severance

Severance is defined as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows.

The Proposed Licence Amendment will result in no changes to traffic flows. On this basis, the assessment of severance will cover existing activities and is unlikely to result in a significant effect.

5.2.6.1.3 Economic Activity and Employment

The Proposed Licence Amendment will require no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites. As such, no new employment opportunities will be generated by the Proposed Licence Amendment, nor will any positions be put at risk by the Proposed Licence Amendment. On this basis, the assessment of economic activity and employment will cover existing activities and is unlikely to result in a significant effect.

5.2.6.1.4 Human Health and Well-Being

This assessment includes impacts on the health and well-being of residents of properties and users of community resources in the study area.

An initial scoping exercise was undertaken to determine the criteria within the HUDU guidance (NHS, 2019) which is relevant to this assessment. The criteria which will be assessed as part of this chapter are listed below. Other criteria in HUDU guidance (NHS, 2019) but not in the list below, have been scoped out:

- Air quality, noise and neighbourhood amenity, and
- Climate change.

The assessment of human health is qualitative rather than quantitative, due to the diverse nature of health determinants and health outcomes which are assessed. Although the assessment of human health effects describes the likely qualitative health outcomes, it is not possible to quantify the severity or extent of the effects which give rise to these impacts. As such, the potential health impacts are described as outlined in Table 5-3, based on broad categories for the qualitative effects identified. Where an effect has been identified, actions have been recommended to mitigate negative impact on health or opportunities to enhance health benefits.

Table 5-3: Effect Categories in the Assessment of Human Health

Effect Category	Effect Symbol	Description
Positive	+	A beneficial effect is identified
Neutral	0	No discernible health effect is identified
Negative	-	An adverse effect is identified
Uncertain	?	Where uncertainty exists as to the overall impact

A summary of the scoping exercise is available in Table 5-4 below.

Table 5-4: Human Health and Well-being Scoping Exercise

Health Determinant	Findings of Scoping Exercise
Housing quality and design	The Proposed Licence Amendment covers the operation of existing mining and factory sites. As such, there would be no displacement of land and property expected as a result of the scheme. There is no housing proposed as part of the Proposed Licence Amendment. Housing quality and design has limited relevance to the Proposed Licence Amendment.
Access to healthcare services and other social infrastructure	The Proposed Licence Amendment does not alter access to healthcare services or other social infrastructure as it does not impact on demand, physical access or land take for such facilities. The scope of the Proposed Licence Amendment means there would be no impact on access to healthcare services or other social infrastructure.

Health Determinant

Findings of Scoping Exercise

Access to open space and nature	The existing mine and factory sites are surrounded by agricultural fields. Given the Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites, the Proposed Licence Amendment is not expected to result in land take from open spaces, or in changes to access to these spaces for users. As such, there would be no impact on access to open space and nature as a result of the Proposed Licence Amendment.
Air quality, noise and neighbourhood amenity	There are limited receptors on which the Proposed Licence Amendment can impact. The Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites. Findings from other topics – air quality, traffic, noise and vibration – will be reviewed to assess the change of amenity expected as a result of the Proposed Licence Amendment.
Accessibility and active travel	The Proposed Licence Amendment will have a limited impact on accessibility and active travel given its location and scope of activities. The scope of the Proposed Licence Amendment means there would be no impact on accessibility and active travel.
Crime reduction and community safety	Given the Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites, the Proposed Licence Amendment is not expected to have any significant effects on crime and community safety.
Access to healthy food	Given the Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites, the Proposed Licence Amendment is not envisaged to have any effect on the availability of food.
Access to work and training	The Proposed Licence Amendment will not create additional jobs at the mine or factory site. The scale of these activities will not change from the existing on-site employment, therefore the effect as a result of the Proposed Licence Amendment is not expected to be significant in EIA terms.
Social cohesion and lifetime neighbourhoods	Given the Proposed Licence Amendment will result in no changes to the design or construction of the mine and factory sites, and there will be no changes to the physical infrastructure of the mine and factory sites, the Proposed Licence Amendment is not displacing existing residential developments. The Proposed Licence Amendment would have limited scope to impact on social cohesion and lifetime neighbourhoods.
Minimising the use of resources	The Proposed Licence Amendment cover the activity of an already operating mine and factory, with no change to land use or waste management expected. The Proposed Licence Amendment would have limited scope to impact on minimising the use of resources.
Climate Change	The Proposed Licence Amendment may result in changes to the climate and freshwater aquatic environment of the existing sites. Findings from other topics – air quality, climate, noise and vibration, water and biodiversity – will be reviewed to assess the extents of change resulting from the Proposed Licence Amendment.

5.2.6.2 Significance of Impact

Once the magnitude of the effect has been identified, this can be cross-referenced with the importance of the sensitivity of the receptor to derive the overall significance of impact as per the EPA guideline (EPA, 2017).

5.2.7 Limitations in the Methodology and Gaps in Information

This population and human health assessment is based on professional judgement and takes into account both the adverse and beneficial impacts that the Proposed Licence Amendment can have upon existing and surrounding receptors. It provides a broad, high level indication of effects, reporting on the potential effects to people and the local community.

Assessment has been based on information about the Proposed Licence Amendment available at the time when the chapter was drafted. It has drawn upon other specialist topic inputs to aid the assessment of the impact of the Proposed Licence Amendment on people and communities' receptors.

Community resources are mentioned expressly in the environmental baseline only where they contribute to the local context or where they may be affected by the Proposed Licence Amendment. Consequently, not all community resources within the study area are mentioned.

Information in the baseline related to demographics and the health profile of the population in the study area uses statistics from the census. Four years have passed since the census was published (2016).

5.3 Description of the Existing Environment & Baseline Information

5.3.1 Overview

The mine site and factory site relating to the Proposed Licence Amendment are located in County Monaghan and County Meath respectively. The study area includes the lands within and adjacent to the mine site and factory site boundaries. The Proposed Licence Amendment will seek to increase the current compliance limit value for sulphate and electrical conductivity at Compliance Point CP-1 from the current level of 200 mg/L to 1,250 mg/L for sulphate and from 1000 μ S/cm to 2,360 μ S/cm for electrical conductivity. Compliance Point CP-1 is located to the east of the mine site circa 70 m downstream of a discharge point into the River Bursk.

The mine site occupied by the Applicant is located within County Monaghan, off the R179 between Kingscourt and Carrickmacross. While the factory site occupied by the Applicant is located within County Meath, off the R162 circa 3 km south of Kingscourt town.

The study area at the mine and factory sites is primarily rural with agricultural fields, residential properties generally along existing road infrastructure and areas of small commercial enterprise. Kingscourt is the closest town to both the mine site and the factory site.

Residential properties occur along the R179 and along local roads surrounding the mine site, the closest is located circa 100 m north west of the mine site along the R179. A small cluster of residential properties occur circa 150 m north of the mine site at Clonseady. At the factory site residential properties occur along the R162 and along local roads to the south and east of the factory site, the closest residential property is located circa 20 m west of the factory site on the opposite side of the R162. A small cluster of residential properties occur circa 150 m south east of the factory site.

Data from the 2016 census by electoral division (ED) has been analysed in the baseline. The study area for this analysis has been defined for the mine site as Enagh ED and for the factory site Carricleck ED. The factory and mine sites are located within these electoral divisions and the residents in these EDs would be the most likely to experience potential effects from the Proposed Licence Amendment. Both EDs have small populations, Enagh ED was reported to have a population of 683 in the 2016 census while Carricleck ED was reported to have a population of 458. Neither Enagh ED or Carricleck ED include Kingscourt town, which is located in County Cavan.

The below analysis compares the population in this study area with:

- County Monaghan for the mine site
- County Meath for the factory site, and
- Ireland.

5.3.2 The Mine Site

This section establishes a comprehensive and coherent socio-economic profile of the mine site, including consideration of the labour market and health indicators. Dependent on the availability of data from the Central Statistics Office (CSO), the baseline section presents analysis of socio-economic indicators which provides the narrative and evidence base of the current status of the mine site. Baseline analysis in this section sets the context for the potential impacts of the Proposed Licence Amendment.

The mine site is situated within Enagh Ed, which itself is situated in the county of Monaghan and the Border Region.

This section establishes the current baseline with regards to the following characteristics relevant to the potential impacts of the mine site:

- Population
- Land uses and local community
- Economic Activity and Employment
- Travel Patterns, and
- Human health.

5.3.2.1 Population

Table 5-5 includes information on population changes in the study area and its comparator areas between 2006 and 2016. The population in Enagh ED has seen a decrease in population over the last ten years. The CSO census 2016 reports that the population decreased by approximately 3.3% from 704 in 2006 to 683 in 2016. Little population growth has occurred between 2011 and 2016, with an increase of just 3 residents between 2011 and 2016. The population growth rate between 2006 and 2016 is considerably lower than that observed in comparator areas which saw an increase in population between 2006 and 2016. Notably, the comparator areas cover a larger area than the electoral division.

Table 5-5 Population and Population Growth

Area	2016	2011	2006	Change between 2011-2016 (%)	Change between 2006-2011 (%)
Electoral division of Enagh	683	681	704	0.3	-3.3
County Monaghan	61,386	60,483	55,997	1.5	8.0
Ireland	4,761,865	4,588,252	4,239,848	3.8	8.2

Source: CSO, census 2016; Small Area Population Statistics 2016.

Table 5-6 shows the percentage of total population for the study area and its comparator areas by age band. In 2016, 60.1% of the residents in Enagh ED were aged between 18 and 64 years. The proportion of working age residents in Enagh ED was relatively higher than the average recorded for County Monaghan (59%) but lower than the average in Ireland (61.5%) as a whole. In addition, Enagh ED has similar proportion of residents aged 17 years or under (27.3%) in comparison to County Monaghan (27%) and Ireland (25%), of these a significantly higher percentage of residents are aged 13-17 (11.6%) compared to County Monaghan (7%) and Ireland (6.5%) as a whole. The proportion of residents aged 65 years or older in Enagh ED (12.7%) was smaller than the average for County Monaghan (14%) and Ireland (13.4%).

Table 5-6 Proportion of Total Population by Age Band

Area	% of Total Population by Age Band						
	0-4 (%)	5-12 (%)	13-17 (%)	18-24 (%)	25-44 (%)	45-64 (%)	65+ (%)
Electoral division of Enagh	6	9.7	11.6	7.5	28.4	24.2	12.7
County Monaghan	7.6	12.4	7	7.1	27.7	24.2	14
Ireland	7	11.5	6.5	8.2	29.5	23.8	13.4

Source: CSO, census 2016; Small Area Population Statistics 2016.

The census provides a breakdown of the total population by 'social class'. These groupings are based on the level of skill and education attainment of their occupation. For the population which does not work, the social class of the person which they are deemed to depend on is attributed to them (as per guidance issued by the CSO). The data shows that the population of the study area is relatively better educated with a higher percentage of people in occupations which require greater skill levels than its comparator areas.

Table 5-7 shows the percentage of population by social class for the study area and its comparator areas. At the time of Census 2016, the relative proportion of population in the 'Semi-Skilled' (12%) and 'Unskilled' (5.4%) social classes in Enagh ED were broadly in line with the average for County Monaghan (13.2% and 5.1 respectively) but higher than the average for Ireland (10.5% and 3.6% respectively). However, Enagh ED and County Monaghan had a noticeably higher population in the 'Skilled' social class (20.5% and 19% respectively) in comparison to Ireland (14.1%).

Enagh ED and County Monaghan also had a significantly lower proportion of population in the 'Professional' social class (4.7% and 5.2% respectively) in comparison to the national average (8.1%). Similarly, Enagh ED and County Monaghan had a lower proportion of population in the 'Managerial / Technical' social class (26.8% and 24.2% respectively) in comparison to the national average (28.1%).

Table 5-7: Proportion of Total Population by Social Class

Area	% of Total Population by Social Class						
	Professional (%)	Managerial / Technical (%)	Non-Manual (%)	Skilled (%)	Semi-Skilled (%)	Un-skilled (%)	Other (%)
Electoral division of Enagh	4.7	26.8	16.7	20.5	12	5.4	13.9
County Monaghan	5.2	24.2	17.3	19	13.2	5.1	16.1
Ireland	8.1	28.1	17.6	14.1	10.5	3.6	18

Source: CSO, census 2016; Small Area Population Statistics 2016.

5.3.2.2 Land Uses and Local Community

The mine site is located within County Monaghan, off the R179 between Kingscourt and Carrickmacross. It includes infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite. The majority of the site comprises of open pit and underground mining with the infrastructure primarily localised around the buildings and lagoons to the south of the site.

The area surrounding the mine site is predominantly used for agricultural purposes. There are some scattered residential properties in the area primarily concentrated along the local roads, with closest residential hamlets including Clonseady approximately 1km north east of the site.

Facilities in close proximity to the site include a petrol station (Top Oil), a post office and a church.

The closest community infrastructure facilities are located in Kingscourt approximately 6 km south west of the site and in Carrickmacross approximately 6.5 km north east of the site.

5.3.2.2.1 Planning Applications

A planning search of granted and pending planning applications made within the vicinity of the site (1 km of the mine site centre, and major developments within 2 km) within the last five years was completed by consulting www.myplan.ie's National Planning Application Database, Monaghan County Council's planning website and An Bord Pleanála's website in August 2020. No finalised applications and reasonably foreseeable developments were identified that could alter existing land uses in proximity of the mine site.

5.3.2.3 Economic Activity and Employment

5.3.2.3.1 Participation Rate and Unemployment

The Labour Force Survey (LFS 2020) highlights total size of the labour force in Q1 of 2020 in the Border Region was 187,700. The Border Region had approximately 10,300 unemployed people aged 15 years or over and approximately 177,400 people aged 15 years or over in employment.

The unemployment rate (15-64 years) in the Border Region (5.5%) in Q1 of 2020 was slightly higher than the national average (4.7%). However, the participation rate (15 years+) in the Border Region (58.1%) was over four percentage points lower than the national average (62.3%).

Table 5-8 below shows the unemployment rate by age at the time of Census in 2016. The unemployment rate (15-64 years) in County Monaghan (13%) was slightly higher than the national average (12.9%) and are similar across the two regions amongst all age groups.

Table 5-8: Unemployment Rate by Age Band

Area	% of Unemployed Population by Age Band						
	All ages (%)	15-24 (%)	25-34 (%)	35-44 (%)	45-54 (%)	55-64 (%)	65+ (%)
County Monaghan	13	23.2	12.8	10.5	12.5	15	5.1
Ireland	12.9	25.6	12.3	10.3	11.3	14.7	5.3

Source: CSO, census 2016; Small Area Population Statistics 2016.

5.3.2.3.2 Live Register

The Live Register is used to provide a monthly series of the numbers of people (with some exceptions) registering for Jobseekers Benefit (JB) or Jobseekers Allowance (JA) or for various other statutory entitlements at local offices of the Department of Social Protection.

Table 5-9 shows that the proportion of residents in the Border Region (63.8%) on the Live Register for less than twelve months was noticeably lower than the national average (69.4%) in July 2020. However, the proportion of residents in the Border Regional Authority (36.2%) on the Live Register for twelve months or more was noticeably higher than the national average (30.6%).

Table 5-9: Live Register

Indicator	Claiming for under 12 months		Claiming for over 12 months		Total	
	Claimants	%	Claimants	%	Claimants	%
Border Region	14,079	63.8%	8,003	36.2%	22,082	-
Ireland	169,822	69.4%	74,740	30.6%	244,562	-

Source: CSO, (2020); Live Register, July 2020.

5.3.2.3.3 Education and Skills

County Monaghan's population is less highly skilled compared to the rest of the country. Table 5-10 shows that, within Monaghan, 20.3% of residents are qualified to Ordinary bachelor's degree / professional qualification and above, which is below the recorded national average (28.5%). County Monaghan also recorded a significantly higher than average proportion of population with no formal or primary education only of (17.0%) compared to national rate (12.5%).

Table 5-10: Highest Level of Education Completed

Indicator	County Monaghan		Ireland	
	No.	%	No.	%
No formal education	998	2.5%	52,214	1.7%
Primary	5,798	14.5%	334,284	10.8%
Lower secondary	7,509	18.8%	449,766	14.5%
Upper secondary	7,176	18.0%	573,643	18.5%
Technical/vocational	3,784	9.5%	271,532	8.8%
Advanced certificate/completed apprenticeship	2,465	6.2%	182,318	5.9%
Higher certificate	1,836	4.6%	153,351	5.0%
Ordinary bachelor degree/professional qualification or both	547	6.4%	237,117	7.7%
Honours bachelor degree/professional qualification or both	3,332	8.3%	331,293	10.7%
Postgraduate diploma or degree	2,098	5.3%	284,107	9.2%
Doctorate (Ph.D.)	114	0.3%	28,759	0.9%
Not stated	2,271	5.7%	198,668	6.4%
Total	39,928	-	3,097,052	-

Source: CSO, (2016); Census 2016.

5.3.2.3.4 Income

Income levels in Monaghan are noticeably lower than across the national average, likely due to the lower-level occupations that the residents in the County tend to hold. However, the median household income in Enagh ED in 2016 was €45,459, comfortably higher than the median rate for Monaghan (€38,920). The median household weekly income within the Enagh ED is in line the average for Ireland – as displayed in Table 5-11.

Table 5-11: Household Income

Indicator	Enagh ED	Monaghan	Ireland
Median household income (€)	45,459	38,920	45,256

Source: CSO, Geographical Profiles of Income in Ireland (2016).

5.3.2.4 Travel Patterns and the Existing Transport Network

Table 5-12 shows the travel time to work, school, or college for residents of the study area and its comparator areas in 2016. The results show that residents in Enagh ED travel longer distances to work, school or college compared to the County Monaghan but shorter than Ireland as a whole. Approximately 66% of respondents from Enagh ED reported spending 29 minutes or less travelling to these destinations, compare to 69% in County Monaghan and 61% in Ireland.

Table 5-12: Travel Time to Work, School or College

Area	% of Total Population by Travel Time to Work, School or College						Not Stated (%)
	Under 15 mins (%)	15-29 mins (%)	30-44 mins (%)	45-60 mins (%)	1-1.5 hours (%)	>1.5 hours (%)	
Electoral division of Enagh	42.4	23.8	13.6	4.3	5.0	2.4	7.2
County Monaghan	40.6	28.4	12.8	3.6	4.3	3.1	7.3
Ireland	32.3	28.8	17.3	5.9	6.0	2.3	7.4

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

Table 5-13 shows the modes of transport most commonly used to travel to work, school, and college for residents of the study area and its comparator areas in 2016. The results show that residents in Enagh ED rely primarily on private vehicles. Approximately 74.9% of residents in Enagh ED travel to their respective destinations by driving or as a passenger in a private vehicle. This is higher than the percentage of residents whom travel by private vehicle in County Monaghan (70.6%) and Ireland (62.2%). Conversely, only 5.5% of residents travel by foot or cycle, which is significantly lower than for County Monaghan (10.3%) and Ireland (16.6%). This is due to the rural location of the study area. Residents are required to travel elsewhere for school and college. Employment opportunities in the area are also limited.

Table 5-13: Travel Mode to Work, School, or College

Area	% of Total Population by Travel Mode to Work, School or College							Not Stated
	Foot	Bicycle	Bus or Coach	Train	Car/Van Driver	Car Passenger	Other	
Electoral division of Enagh	4.5	1.0	10.6	0.1	49.8	25.1	3.8	2.5
County Monaghan	9.8	0.5	10.2	0.1	48.7	21.9	5.0	3.8
Ireland	13.9	2.7	10.2	2.7	43.5	18.6	3.8	4.5

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

5.3.2.5 Human Health and Well-being

5.3.2.5.1 Life Expectancy

The life expectancies in the Border Region and Ireland have been increasing in recent years creating an ageing population, a trend that is currently being experienced across most developed countries. In 2016, male residents in the Border Region were expected to live to 79.5 years whilst female residents were expected to live to 83.5 years, compared to 78.6 years and 82.9 years respectively in 2011⁷.

5.3.2.5.2 Self-Perceived Health

The results of a self-assessment of health in the Census 2016 are available in Table 5-14 below. The health conditions in Enagh ED are better than the averages for County Monaghan and Ireland. In 2016, 89.0% of the population aged 15 years and over in Enagh ED considered themselves to be in very good or good health, which is higher than the rate for Monaghan (87.6%) and the overall rate for Ireland (87.0%).

At the time of Census 2016, 0.7% of residents in Enagh ED considered themselves to be in bad or very bad health, which is significantly lower than the rate for Monaghan (1.3%) but higher than the overall rate for Ireland (1.6%).

⁷ CSO, (2017); Irish Life Tables: Period Life Expectancy by Sex, Age, Region and Year.

Table 5-14: Health Conditions for All Persons Aged 15+ Years

Area	Health Conditions for All Persons Aged 15+ Years (%)					
	Very good	Good	Fair	Bad	Very Bad	Not Stated
Electoral division of Enagh	66.0	23.0	7.9	0.4	0.3	2.4
County Monaghan	59.6	28.0	8.6	1.1	0.2	2.5
Ireland	59.4	27.6	8.0	1.3	0.3	3.3

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

5.3.2.5.3 Disabilities

Table 5-15 shows the proportion of the population with a disability in the study area and its comparator areas. In the Census 2016, a disability has been defined as a long-lasting condition or difficulty and may be physical or mental. In 2016, 10.7% of residents in Enagh ED stated that they had a disability. This is lower than the rate recorded in both Monaghan (11.8%) and Ireland (13.5%) as a whole.

Table 5-15: Proportion of the Population with a Disability

Area	Proportion of population with a Disability (%)
Electoral division of Enagh	10.7
County Monaghan	11.8
Ireland	13.5

Source: CSO, census 2016.

5.3.2.5.4 Mental Health

The Irish Health Survey⁸ reports the mental health status of residents (aged 15 year and over). In 2015, 74% of residents stated they experience no or minimal depression in the Border Region, which was the same as across Ireland (74%). The full mental health statistics for Border Region and Ireland are shown in Table 5-16, which indicates on the whole residents in the Border Region experience similar levels of depression as residents across the county.

Table 5-16: Mental Health Status for All Persons Aged 15+ Years

Mental Health Indicator	Border Region	Ireland
None to minimal depression	74%	74%
Mild depression	17%	18%
Moderate depression	6%	5%
Moderately severe or severe depression	3%	3%

Source: CSO (Ireland) (2015), Irish Health Survey 2015.

5.3.3 The Factory Site

This section establishes a comprehensive and coherent socio-economic profile of the factory site, including consideration of the labour market and health indicators. Dependent on the availability of data from the Central Statistics Office (CSO), the baseline section presents analysis of socio-economic indicators which provides the narrative and evidence base of the current status of the mine site. Baseline analysis in this section sets the context for the potential impacts of the Proposed Licence Amendment.

The factory site is situated within the Carricleck Electoral Division (ED), which itself is situated in the county of Meath and the Mid-East Region.

⁸ CSO, (2015), Irish Health Survey 2015.

This section establishes the current baseline with regards to the following characteristics relevant to the potential impacts of the mine site:

- Population
- Land uses and local community
- Economic Activity and Employment
- Travel Patterns, and
- Human health.

5.3.3.1 Population

As shown Table 5-17 population changes in the study area and its comparator areas between 2006 and 2016. The population in Carricleck ED has seen the population remain similar over the last ten years. The CSO census 2016 reports that an increase in population had occurred between 2006 and 2011 from 456 to 473 however the population decreased by 3.17% from 456 in 2006 to 458 between 2011 and 2016. The population growth rate between 2006 and 2016 is considerably lower than that observed in comparator areas which saw an increase in population between 2006 and 2016. Notably, the comparator areas cover a large area than the electoral division.

Table 5-17: Population and Population Growth

Area	2016	2011	2006	Change between 2011-2016 (%)	Change between 2006-2011 (%)
Electoral division of Carricleck	458	473	456	-3.17	3.7
County Meath	195,044	184,135	162,831	5.92	13.1
Ireland	4,761,865	4,588,252	4,239,848	3.8	8.2

Source: CSO, census 2016; Small Area Population Statistics 2016.

Table 5-18 shows the percentage of total population for the study area and its comparator areas by age band. In 2016, 60.5% of the residents in Carricleck ED were aged between 18 and 64 years. The proportion of working age residents in Carricleck ED was relatively higher than the average recorded for County Meath (60.1%) but lower than the average in Ireland (61.5%) as a whole. In addition, Carricleck ED had a noticeably lower proportion of residents aged 17 years or under (21.3%) in comparison to County Meath (29.3%) and Ireland (25%). Of these, Carricleck ED had a significantly lower percentage of residents aged 0-4 (4.4%) compared to County Meath (8.1%) and Ireland (7%) as a whole. Similarly, the proportion of residents aged 65 years or older in Carricleck ED (18.3%) was significantly higher than the average for County Meath (10.7%) and Ireland (13.4%).

Table 5-18: Proportion of Total Population by Age Band

Area	% of Total Population by Age Band						
	0-4 (%)	5-12 (%)	13-17 (%)	18-24 (%)	25-44 (%)	45-64 (%)	65+ (%)
Electoral division of Carricleck	4.4	10.3	6.6	8.5	24.5	27.5	18.3
County Meath	8.1	13.9	7.3	7.3	29.4	23.4	10.7
Ireland	7	11.5	6.5	8.2	29.5	23.8	13.4

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

The census provides a breakdown of the total population by 'social class'. These groupings are based on the level of skill and education attainment of their occupation. For the population which does not work, the social class of the person which they are deemed to depend on is attributed to them (as per guidance issued by the CSO). The data shows that the population of the study area is relatively better educated with a higher percentage of people in occupations which require greater skill levels than its comparator areas.

Table 5-19 shows the percentage of population by social class for the study area and its comparator areas. In 2016, the relative proportion of population in the 'Semi-Skilled' (11.4%) and 'Unskilled' (5.5%) social classes in Carricleck ED is higher than the average for County Meath (10.3% and 3.6%) and the average for Ireland (10.5% and 3.6%). However, Carricleck ED and County Meath have a noticeably higher proportion of population in the 'Skilled' social class (20.7% and 16.3%) in comparison to Ireland (14.1%).

At the time of Census 2016, Carricleck ED had a significantly lower proportion of population in the 'Professional' social class (2.6%) in comparison to County Meath and the national average (7.7% and 8.1%). However, Carricleck ED a similar proportion of population in the 'Managerial / Technical' social class (27.9%) in comparison to the national average (28.1%) but lower than in County Meath (30.5%).

Table 5-19: Proportion of Total Population by Social Class

Area	% of Total Population by Social Class						
	Professional (%)	Managerial/ Technical (%)	Non-Manual (%)	Skilled (%)	Semi-Skilled (%)	Un-skilled (%)	Other (%)
Electoral division of Carricleck	2.6	27.9	18.3	20.7	11.4	5.5	13.5
County Meath	7.7	30.5	18.4	16.3	10.3	3.6	13.2
Ireland	8.1	28.1	17.6	14.1	10.5	3.6	18

Source: CSO, census 2016; Small Area Population Statistics 2016
Note: Figures may not sum to those presented in preceding paragraph due to rounding.

5.3.3.2 Land Uses and Local Community

The factory site is located south of the town of Kingscourt, across the Cavan County border in County Meath. The site is located in a low lying valley on the eastern edge of the R162. The factory site consists of onsite buildings and hardstanding to the west and a historical onsite landfill to the east of the site, a historical railway line running in a north-south alignment is present on the western landfill boundary.

The area surrounding the factory site is predominantly used for agricultural purposes. There are some scattered residential properties in the area primarily concentrated along the R162 and along the local roads, the closest residential property is located circa 20 m west of the factory site on the opposite side of the R162. A small cluster of residential properties occur circa 150 m south east of the factory site.

The closest community facilities, including schools and primary healthcare facilities, are located in Kingscourt approximately 4 km north west of the site.

5.3.3.2.1 Planning Applications

A planning search of granted and pending planning applications made within the vicinity of the site (1 km of the factory site centre, and major developments within 2 km) within the last five years was completed by consulting www.myplan.ie's National Planning Application Database, Meath County Council's planning website and An Bord Pleanála's website in August 2020. No finalised applications and reasonably foreseeable developments were identified that could alter existing land uses in proximity of the factory site.

5.3.3.3 Economic Activity and Employment

5.3.3.3.1 Participation Rate and Unemployment

The Labour Force Survey (LFS 2020) highlights total size of the labour force in Q1 of 2020 in the Mid-East Region was 355,900. The Mid-East Region had approximately 4,300 unemployed people aged 15 years or over and approximately 340,500 people aged 15 years or over in employment.

The unemployment rate (15-64 years) in the Mid-East Region (4.3%) in Q1 of 2020 was slightly lower than the national average (4.7%). However, the participation rate (15 years+) in the Mid-East Region (62.6%) was slightly higher than the national average (62.3%).

Table 5-20 below shows the unemployment rate by age at the time of Census 2016. The unemployment rate (15-64 years) in County Meath (11.2%) was lower than the national average (12.9%) and is consistently lower across all age bands.

Table 5-20: Unemployment Rate by Age Band

Area	% of Unemployed Population by Age Band						
	All ages (%)	15-24 (%)	25-34 (%)	35-44 (%)	45-54 (%)	55-64 (%)	65+ (%)
County Meath	11.2	23.8	11.5	8.6	9.6	13.6	4.8
Ireland	12.9	25.6	13	10.3	11.3	14.7	5.3

Source: CSO, census 2016; Small Area Population Statistics 2016.

5.3.3.3.2 Live Register

The Live Register is used to provide a monthly series of the numbers of people (with some exceptions) registering for Jobseekers Benefit or Jobseekers Allowance or for various other statutory entitlements at local offices of the Department of Social Protection.

Table 5-21 shows that the proportion of residents in the Mid-East Region (34.4%) on the Live Register for twelve months or more was noticeably higher than the national average (30.6%) in July 2020. However, the proportion of residents in the Mid-East Region (65.6%) on the Live Register for less than twelve months was lower than the national average (69.4%) at the time of survey.

Table 5-21: Live Register

Indicator	Claiming for under 12 months		Claiming for over 12 months		Total	
	Claimants	%	Claimants	%	Claimants	%
Mid-East Region	18,964	65.6%	9,962	34.4%	28,926	-
Ireland	169,822	69.4%	74,740	30.6%	244,562	-

Source: CSO, (2020); Live Register, July 2020.

5.3.3.3.3 Education and Skills

County Meath's population has similar levels of education compared to the rest of the country. Table 5-22 shows that within Meath, 26.4% of residents are qualified to Ordinary bachelor's degree / professional qualification and above, which is below the recorded national average (28.5%). Similarly, Meath recorded a higher proportion of residents who attained technical / vocation education or completed an apprenticeship (16.6%) in comparison to the national average (14.7%).

Table 5-22: Highest Level of Education Completed

Indicator	County Monaghan		Ireland	
	No.	%	No.	%
No formal education	1,672	1.4%	52,214	1.7%
Primary	11,622	9.6%	334,284	10.8%
Lower secondary	18,264	15.0%	449,766	14.5%
Upper secondary	24,214	19.9%	573,643	18.5%

Indicator	County Monaghan		Ireland	
	No.	%	No.	%
Technical/vocational	11,844	9.8%	271,532	8.8%
Advanced certificate/completed apprenticeship	8,302	6.8%	182,318	5.9%
Higher certificate	6,768	5.6%	153,351	5.0%
Ordinary bachelor degree/professional qualification or both	9,770	8.0%	237,117	7.7%
Honours bachelor degree/professional qualification or both	12,136	10.0%	331,293	10.7%
Postgraduate diploma or degree	9,444	7.8%	284,107	9.2%
Doctorate (Ph.D.)	739	0.6%	28,759	0.9%
Not stated	6,604	5.4%	198,668	6.4%
Total	121,379	-	3,097,052	-

Source: CSO, (2016); Census 2016.

5.3.3.3.4 Income

Income levels in County Meath are noticeably higher than across the national average, likely helped by the high-level occupations that the residents in the region tend to hold. The median household income in Carricleck ED in 2016 was €51,517, comfortably higher than the median rate for Ireland (€45,256). The median household income within Carricleck ED is lower than the average for County Meath – as displayed in Table 5-23.

Table 5-23: Household Income

Indicator	Electoral division of Carricleck	County Meath	Ireland
Median household income (€)	51,517	52,156	45,256

Source: CSO, Geographic Profiles of Income in Ireland (2016).

5.3.3.4 Travel Patterns and the Existing Transport Network

Table 5-24 shows the travel time to work, school, or college for residents of the study area and its comparator areas in 2016. The results show that residents in Carricleck ED travel shorter distances to work, school or college compared to residents in County Meath but longer distances than Ireland as a whole. Approximately 56.6% of respondents from Carricleck ED reported spending 29 minutes or less travelling to these destinations, compared to 54.8% in County Meath and 61.1% in Ireland.

Table 5-24: Travel Time to Work, School or College

Area	% of Total Population by Travel Time to Work, School or College						
	Under 15 mins (%)	15-29 mins (%)	30-44 mins (%)	45-60 mins (%)	1-1.5 hours (%)	>1.5 hours (%)	Not Stated (%)
Electoral division of Carricleck	38.1	18.5	13.6	6.4	10.2	5.3	7.9
County Meath	30.9	23.8	16.4	8.1	10.9	3.8	6.0
Ireland	32.3	28.8	17.3	5.9	6.0	2.3	7.4

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

Table 5-25 shows the modes of transport most commonly used to travel to work, school, and college for residents of the study area and its comparator areas in 2016. The results show that residents in Carrickleck ED rely primarily on private vehicles. Approximately 71.3% of residents in Carrickleck ED travel to their respective destinations by driving or as a passenger in a private vehicle. This is higher than the percentage of residents whom travel by private vehicle in County Meath (66.8%) and Ireland (62.2%). Conversely, only 6.0% of residents travel by foot or cycle, which is significantly lower than for County Meath (13.4%) and Ireland (16.6%). This is due to the rural location of the study area. Residents are required to travel elsewhere for school and college. Employment opportunities in the area are also limited.

Table 5-25: Travel Mode to Work, School, or College

Area	% of Total Population by Travel Mode to Work, School or College							
	Foot	Bicycle	Bus or Coach	Train	Car/Van Driver	Car Passenger	Other	Not Stated
Electoral division of Enagh	4.6	1.4	11.7	0.0	50.4	20.9	7.1	3.9
County Monaghan	12.6	0.9	11.4	1.5	48.0	18.8	3.6	3.3
Ireland	13.9	2.7	10.2	2.7	43.5	18.6	3.8	4.5

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

5.3.3.5 Human Health and Well-being

5.3.3.5.1 Life Expectancy

The life expectancies in the Mid-East Region and Ireland have been increasing in recent years creating an ageing population, a trend that is currently being experienced across most developed countries. In 2016, male residents in the Mid-East Region were expected to live to 80.3 years whilst female residents were expected to live to 84.0 years, compared to 79.0 years and 83 years respectively in 2011⁹.

5.3.3.5.2 Self-Perceived Health

The results of a self-assessment of health in the 2016 census are available in Table 5-26. The health conditions in Carrickleck ED are worse than the averages for County Meath and Ireland. In 2016, 86.0% of the population aged 15 years and over in Carrickleck ED considered themselves to be in very good or good health, which is considerably lower than the rate for Meath (89.6%) and the overall rate for Ireland (87.0%).

At the time of Census 2016, 1.3% of residents in Carrickleck ED considered themselves to be in bad or very bad health, which is broadly in line with the rate for Meath (1.2%) but lower than the overall rate for Ireland (1.6%).

Table 5-26: Health Conditions for All Persons Aged 15+ Years

Area	Proportion of Population by General Health (%)					
	Very good	Good	Fair	Bad	Very Bad	Not Stated
Electoral division of Carrickleck	55.7	30.3	11.4	1.3	0.0	1.3
County Meath	63.1	26.5	6.7	1.0	0.2	2.4
Ireland	59.4	27.6	8.0	1.3	0.3	3.3

Source: CSO, census 2016; Small Area Population Statistics 2016.

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

5.3.3.5.3 Disabilities

Table 5-27 shows the proportion of the population with a disability in the study area and its comparator areas. In the Census 2016, a disability has been defined as a long-lasting condition or difficulty and may be physical or mental. In 2016, 15.7% of residents in Carrickleck ED stated that they had a disability. This is higher than the rate recorded in both Meath (11.6%) and Ireland (13.5%) as a whole.

⁹ CSO, (2017); Irish Life Tables: Period Life Expectancy by Sex, Age, Region and Year.

Table 5-27: Proportion of the Population with a Disability

Area	Proportion of population with a Disability (%)
Electoral division of Carricleck	15.7
County Meath	11.6
Ireland	13.5

Source: CSO, census 2016; Small Area Population Statistics 2016.

5.3.3.5.4 Mental Health

The Irish Health Survey¹⁰ reports the mental health status of residents (aged 15 year and over). In 2015, 74% of residents stated they experience no or minimal depression in the Mid-East Region, which was the same as across Ireland (74%). The full mental health statistics for Mid-East Region and Ireland are shown in Table 5-28, which indicates on the whole residents in the Mid-East Region experience same levels of depression as residents across the county.

Table 5-28: Mental Health Status for All Persons Aged 15+ Years

Mental Health Indicator	Border Region	Ireland
None to minimal depression	74%	74%
Mild depression	18%	18%
Moderate depression	5%	5%
Moderately severe or severe depression	3%	3%

Source: CSO (Ireland) (2015), Irish Health Survey 2015.

5.4 Assessment of Potential Impacts

5.4.1 The Mine Site

5.4.1.1 Land Use and Local Community

The Proposed Licence Agreement will result in no changes to the design or construction of the mine site, and there will be no changes to the physical infrastructure. As such, the impact of the Proposed Licence Agreement is assessed to be a permanent negligible (not significant) effect for land uses and local community.

5.4.1.2 Economic Activity and Employment

No direct impacts on employment are expected as a result of the operation of the Proposed Licence Amendment. Therefore, the influence of the Proposed Licence Amendment on access to work and training during operation is assessed to be a permanent negligible (not significant) effect for residents in the study area.

5.4.1.3 Severance

The Proposed Licence Amendment will not require any changes to transport network or volume of traffic on local roads. As such, the Proposed Licence Amendment is assessed to have a permanent negligible (not significant) impact on severance between residents and community resources.

More information regarding congestion on the transport network is available in *Chapter 4: Traffic and Transport*.

5.4.1.4 Human Health and Well-Being

This section summarises the impact of the proposed Relevant Action on human health and well-being, structured by health determinants as set out in *London HUDU Rapid Health Impact Assessment Tool*.

¹⁰ CSO, (2015), Irish Health Survey 2015.

5.4.1.4.1 Air Quality, Noise and Neighbourhood Amenity

Given its nature, the Proposed Licence Amendment will not result in any significant change to the local air quality environment, the local noise environment or the existing road network (see *Chapter 4: Traffic and Transport*, *Chapter 9: Air Quality* and *Chapter 11: Noise and Vibration*).

Therefore, the impact of the Proposed Licence Amendment on air quality, noise and neighbourhood amenity as a determinant of human health and well-being is assessed to be neutral (0).

5.4.1.4.2 Climate Change

Given its nature, the Proposed Licence Amendment is not expected to result in changes to the climate of the existing mine site (see *Chapter 9: Air Quality* and *Chapter 10: Climate*).

The Proposed Licence Amendment may have potential impacts on the freshwater aquatic environment (see *Chapter 6: Biodiversity*). It is expected that implementation of mitigation measures would be adopted to prevent and minimise potentially significant effects. Such effects are considered to have limited scope to impact on human health.

A known drinking water abstraction (Tallanstown pumping station) is located circa 18 km downstream of Compliance Point CP-1 (see *Chapter 8: Hydrology and Hydrogeology*). However, water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Where an exceedance is noted this would affect taste rather than posing a health risk.

Therefore, the impact of the Proposed Licence Amendment on climate change as a determinant of human health and well-being is assessed to be neutral (0).

5.4.2 The Factory Site

5.4.2.1 Land Use and Local Community

The Proposed Licence Agreement will result in no changes to the design or construction of the factory site, and there will be no changes to the physical infrastructure. As such, the impact of the Proposed Licence Agreement is assessed to be a permanent negligible (not significant) effect for land uses and local community.

5.4.2.2 Economic Activity and Employment

No direct impacts on employment are expected as a result of the operation of the Proposed Licence Amendment. Therefore, the influence of the Proposed Licence Amendment on access to work and training during operation is assessed to be a permanent negligible (not significant) effect for residents in the study area.

5.4.2.3 Severance

Given the Proposed Licence Amendment will not require any changes to transport network or volume of traffic on local roads, the Proposed Licence Amendment is assessed to have a permanent negligible (not significant) impact on severance between residents and community resources.

More information regarding congestion on the transport network is available in *Chapter 4: Traffic and Transport*.

5.4.2.4 Human Health and Well-Being

This section summarises the impact of the proposed Relevant Action on human health and well-being, structured by health determinants as set out in *London HUDU Rapid Health Impact Assessment Tool*.

5.4.2.4.1 Air Quality, Noise and Neighbourhood Amenity

Given its nature, the Proposed Licence Amendment will not result in any significant change to the local air quality environment, the local noise environment or the existing road network (see *Chapter 4: Traffic and Transport*, *Chapter 9: Air Quality* and *Chapter 11: Noise and Vibration*).

Therefore, the impact of the Proposed Licence Amendment on air quality, noise and neighbourhood amenity as a determinant of human health and well-being is assessed to be neutral (0).

5.4.2.4.2 Climate Change

Given its nature, the Proposed Licence Amendment is not expected to result in changes to the climate of the existing factory site (see *Chapter 9: Air Quality* and *Chapter 10: Climate*).

The Proposed Licence Amendment may have potential impacts on the freshwater aquatic environment (see *Chapter 6: Biodiversity*). It is expected that implementation of mitigation measures would be adopted to prevent and minimise potentially significant effects. Such effects are considered to have limited scope to impact on human health.

A known drinking water abstraction (Tallanstown pumping station) is located circa 18 km downstream of Compliance Point CP-1 (see Chapter 8: Hydrology and Hydrogeology). However, water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Where an exceedance is noted this would affect taste rather than posing a health risk.

Therefore, the impact of the Proposed Licence Amendment on climate change as a determinant of human health and well-being is assessed to be neutral (0).

5.5 Mitigation Measures

The assessed impacts associated with the Proposed Licence Amendments are expected to be neutral. Therefore, no additional mitigation measures are required at the mine or factory sites.

5.6 Cumulative Impacts

None predicted.

5.7 Residual Impacts

The assessed impacts associated with the Proposed Licence Amendments are expected to be neutral. Therefore, no additional mitigation measures are required at the mine or factory sites.

5.8 Summary

As part of the assessment of impacts on population, the overall classification and significance of each effect has been assessed across the study area. A summary of the potential effects on population for the mine and factory sites are identified in Table 5-29.

Table 5-29: Summary of Impacts

Description of Effect	Nature of Effect / Geographic Scale	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation	Residual Effect Classification and Significance
Amenity and Local Communities	Permanent / Local	Low	Negligible	None	Negligible (not significant)
Employment Opportunities	Permanent / Local	Low	Negligible	None	Negligible (not significant)
Severance	Permanent / Local	Low	Negligible	None	Negligible (not significant)

As part of the assessment of impacts on human health, the overall classification each health determinant has been assessed across the study area. A summary of the potential effects on human health is identified in Table 5-30.

Table 5-30: Human Health Summary of Potential Effects

Health Determinant	Potential Health Impact
Air Quality, Noise and Neighbourhood Amenity	Neutral (0)
Climate Change	Neutral (0)

6 Biodiversity

6.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the ecological impacts and effects of the Proposed Licence Amendment. Where appropriate, it provides details of proportionate mitigation. It incorporates assessment of all relevant ecological features, both aquatic and terrestrial. The Proposed Licence Amendment concerns concentration and conductivity in discharge from the mine site; however, the factory site (processing site) that is associated with, but geographically separate from, the mine site is also considered. Chapter 3 of this EIAR provides a detailed project description, and Chapter 8 assesses effects on hydrology and hydrogeology.

This chapter is supported by Figures A6-1, A6-2 and A6-3 in Volume 3 Appendix A.6.2 and Graphs 1 to 4 in Volume 3 Appendix A.6.3.

The potential for significant effects on downstream European sites has been addressed through an Appropriate Assessment reported in a Natura Impact Statement (NIS) (AECOM, 2020). The NIS is referenced in this Chapter, where relevant (Volume 3, Appendix A.6.1). The macroinvertebrate survey carried out for this assessment in 2020 is provided in Appendix A.6.4.

Throughout this Chapter, species are given their scientific names when first referred to and their common names only thereafter. Given that the Proposed Licence Amendment concerns mine water discharge into a river system, stated distances are typically as measured along intervening watercourse(s), and only as the shortest boundary to boundary distance 'as the crow flies' where specified.

6.2 Methodology

6.2.1 Legislation and Guidance

This assessment has been undertaken within the context of the following relevant legislative instruments, planning policies and guidance documents:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive')
- Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive')
- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the 'Water Framework Directive')
- Convention on Wetlands of International Importance ('Ramsar convention')
- The Planning & Development Act 2000 S.I. 30/2000 as amended; the Planning and Development (Amendment) Act 2010 S.I. 30/2010 as amended; The Planning & Development (Amendment) Act 2010 S.I. 16/2018 as amended (collectively known as the 'Planning Acts')
- European Communities (Bird and Natural Habitats) Regulations 2011 and 2015 (the 'Habitats Regulations') (Government of Ireland (2011) & (Government of Ireland (2015))
- The Wildlife Act 1976 and the Wildlife (Amendment) Act 2000 (together known as the 'Wildlife Acts')
- Flora (Protection) Order 2015 S.I. 356/2015 (the 'Flora Protection Order') (Government of Ireland (2015))
- EC Environmental Objectives (Surface Waters) Regulations 2009 (SI 272 of 2009) (Government of Ireland (2009))
- National Biodiversity Plan 2017 – 2021 (DoCHG (2017))
- Project Ireland 2040 National Planning Framework (NPF) (Government of Ireland (2018)) and,
- Monaghan County Development Plan 2019 – 2025 MoCC (2019).

Aside from the protection of sites and species afforded by many of the above legislative instruments, of particular relevance in this case was the Water Framework Directive (WFD). The WFD requires that waterbodies (including watercourses) achieve 'good' status by set deadlines. Since the overall status assigned a given waterbody is the lowest assessed status for biological, hydromorphological and physio-chemical elements, it follows that good status cannot be achieved without good biological status.

The assessment of potential effects on biodiversity features was carried out following the guidelines for Ecological Impact Assessment published by the Chartered Institute for Ecology and Environmental Management (CIEEM, 2018).

6.2.2 Study Area

The likely zone of impact (also referred to as the likely 'zone of influence') of a plan or project is the geographic extent over which significant ecological effects are likely to occur. Department of the Environment, Heritage and Local Government guidance (DoEHLG, 2010) prescribes a 15 km distance threshold from the boundary of a plan area for European sites (Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), the most important types of designated nature conservation site by virtue of their international designation). For nationally-designated sites, a lower distance threshold is appropriate. However, in the case of projects, DoEHLG (2010) acknowledges that the zone of influence must be determined on a case by case basis with reference to the following criteria: the nature, size / scale and location of the project, sensitivity of ecological features, and potential for direct, indirect and / or cumulative (in-combination) effects.

Consideration has also been given to the source-pathway-receptor approach. This is a standard tool in environmental assessment. In order for an effect to occur, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism means there is no likelihood for an effect to occur. Furthermore, where an impact is predicted to occur, it may not result in significant effects.

In the first instance, therefore, a search was made for European designated sites within 15 km of the mine site, and for other designated nature conservation sites within 2 km. Potential impact pathways to designated nature conservation sites further afield were then considered. Since the Proposed Licence Amendment involves mine water discharge into a river system, there is a hydrological connection to downstream sites, all of which are considered relevant up to and including those at Dundalk Bay. Additionally, severe pollution effects in the River Bursk may affect movement of migratory fish in the River Bursk or potentially the River Glyde, therefore a review was also undertaken of upstream designated sites.

Protected and notable habitats and species existing within, adjacent to or otherwise reliant upon downstream watercourses are also considered relevant, as well as migratory fish and the connectivity between spawning habitat that may be affected by pollution effects in the River Bursk. The study area for assessment of biodiversity therefore includes both upstream and downstream watercourses.

6.2.3 Ecological Features Screened Out of the Assessment

There are no nationally designated sites upstream of the River Bursk where the mine water is discharged, but there are several proposed Natural Heritage Areas (pNHAs) within tributaries upstream of the River Glyde. The mine discharge itself cannot reach these sites, but there could be impacts on them if they support migratory aquatic designated species (or designated species dependent on such migratory species), whose movement to and from downstream reaches could potentially be affected by downstream water quality.

The following pNHAs in tributaries upstream of the River Glyde are not designated for any migratory aquatic species or any species that may rely on such species: Reaghstown Marsh (site code: 001828), Louth Hall and Ardee Woods (site code: 001616), Ardee Cutaway Bog (site code: 001454), Mentrim Lough (site code: 001587), Spring and Corcrin Loughs (site code: 001671), Nafarty Fen (site code: 002077), and Creevy Lough (site code: 001599). Therefore, no effect is considered possible on these nationally designated sites, and they are not considered further in this assessment.

Several protected species are likely to occur in the wider area but are not dependent on the river system in any way. These would include, for example, badger *Meles meles* and stoat *Mustela erminea*. They are not considered in this assessment, because it is evident that no significant effect upon them is likely from a development comprising mine water discharge into a river system.

6.2.4 Determination of the Baseline Environment

The baseline environment has been established through desk study, and, since macroinvertebrates are good indicators of water quality, by targeted macroinvertebrate surveys.

Desk study

The desk study included review of previous field surveys undertaken by third parties.

It identified nature conservation designations and protected and notable habitats and species potentially relevant to the Proposed Licence Amendment. The zones and connected areas used for this purpose are described under 'Study area' above (Section 6.2.2).

Relevant nature conservation site designations include European sites, Natural Heritage Areas (NHAs), pNHAs, National Parks, Nature Reserves, rivers that are designated in the Salmonid Regulations (S.I. 293/1988).¹¹

Potentially relevant protected and notable species include:

- All habitats and species listed on Annexes I and II respectively of the Habitats Directive, which listing indicates importance in a European context and affords protection if designated as Qualifying Interests (QI) of SAC
- All species listed on Annex IV of the Habitats Directive, which are known as European Protected Species and are subject to strict protection anywhere they occur
- All species listed on Annex I of the Birds Directive, which listing indicates importance in a European context and affords protection where designated as Special Conservation Interest (SCI) of SPA
- All species listed on the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000 (together known as the 'Wildlife Acts')
- All fish species and habitats protected under the Fisheries Consolidation Act 1959 (No. 14 of 1959), as amended, the Inland Fisheries Act 2010 (No. 10 of 2010) as amended, and the Local Government (Water Pollution Acts) 1977-1990, as amended
- All plant species listed on the Flora (Protection) Order, 2015 (S.I. No. 356/2015) (hereafter 'the Flora Protection Order')
- Species and habitats listed on the National Biodiversity Action Plan 2017 - 2021
- Species that are Nationally Rare, Nationally Scarce or listed in Red Data Lists, which are published by the National Parks and Wildlife Service (NPWS) in collaboration with relevant Northern Irish agencies (e.g. Marnell *et al*, 2009; Regan *et al*, 2010, King *et al*, 2011, Lockhart *et al*, 2012, Nelson *et al*, 2011; Colhoun and Cummins, 2013; Wyse-Jackson *et al*, 2016) and,
- Invasive non-native species of plants and animals listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (hereafter 'scheduled invasive species') and those considered to be species of EU concern under the EU Invasive Alien Species Regulation.

The desk study also incorporated research into the limits and effects of relevant water quality parameters on biodiversity, and data on water quality and related information gathered from existing reports and on-line sources.

The sources used during the desk study are detailed below:

- Environmental Protection Agency (EPA) maps website (<https://gis.epa.ie/EPAMaps/>)
- Ordnance Survey Ireland (OSI) historical mapping (<https://www.osi.ie/>)
- NPWS Protected Sites in Ireland website (<https://www.npws.ie/protected-sites>)
- The Status of EU Protected Habitats and Species in Ireland (Article 17 Report) (<https://www.npws.ie/publications/article-17-reports/article-17-reports-2019>)
- Information on local watercourses (www.catchments.ie) and water quality (www.epa.ie)
- Information on soils, geology and hydrology in the local area (www.gsi.ie)
- Records from National Inventory of Architectural Heritage (<https://www.buildingsofireland.ie/>)

¹¹ S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988

- Records of species held online by the National Biodiversity Data Centre (NBDC) (excluding records more than 50 years old)
- Records of rare and protected species requested from NPWS in the 10 km grid N89
- Records of fish species held online by Inland Fisheries Ireland (IFI)
- Conservation status of vascular plants, amphibians, reptiles, freshwater fish, butterflies, and terrestrial mammals, as per the Irish Red Lists
- River Basin Management Plan for Ireland 2018 – 2021 DoHLGH (2018).=
- Monaghan County Development Plan 2019 – 2025
- EPA River Quality Surveys: Biological (06 – Newry, Fane, Glyde and Dee) (EPA, 2020)
- Newry-Fane-Glyde-Dee Catchment Assessment 2010 – 2015 (HA 06) (EPA, 2018)
- Re: Licence Review – Saint-Gobain Construction Products (Ireland) Limited Ref. No.: P0519-04 (IFI, 2019)
- Water quality monitoring point data (October 2018 to January 2020) from Saint-Gobain Construction Products (Ireland) Limited (SGCPIL, 2020)
- Drummond Mine Water Management Plan (2019 to 2020) (SLR, 2019a)
- Appropriate Assessment: Screening Report for Industrial Emissions (IE) Licence Review Drummond Mine, County Monaghan (SLR, 2019b)
- IEL P0519-03 Review: Attachment 1-1 Reasons for Licence Review (SLR, 2019c)
- Knocknacran Open-Pit Mine Environmental Impact Statement (Golder Associates, 2017)
- River Bursk Electrofishing Survey (SLR, 2019d)
- Biological Impacts Assessment of the MSE1 discharge from the Mine Site 2018 (KD Environmental Ltd, 2018)
- Biological Impacts Assessment of the MSE1 discharge from the Mine Site 2019 (KD Environmental Ltd, 2019) and,
- Available peer-reviewed scientific research into the effects of sulphate, calcium and conductivity on aquatic habitats and organisms.

Macroinvertebrate survey

Full details of the macroinvertebrate survey methodology are provided in the Macroinvertebrate Sampling and Analysis report (Flynn Furney Environmental Consultants, 2020) in Volume 3, Appendix A.6.4. Macroinvertebrate samples were taken on 08 and 09 July 2020 at four locations on the River Bursk and one on the River Glyde upstream of the confluence, using Freshwater Biological Association approved kick-sampling methods and equipment. Preserved samples were then analysed, and the 'Q' value determined for each sample in accordance with EPA guidance.

The Q values scale ranges from 1 to 5 where the higher the number the better the WFD status. Intermediates are indicated with a hyphen e.g. Q2-3. Thus Q1 to Q2 all equate to a WFD status of 'Bad' (seriously polluted), Q2-3 and Q3 equate to 'Poor' (moderately polluted), Q3-4 equates to 'Moderate' (slightly polluted), and Q4 to Q5 equate to 'Good' to 'High' (both unpolluted). Q1 to Q3 are all considered to be in unsatisfactory condition.

The sample sites in the River Bursk (termed 1 to 4 in the macroinvertebrate report) were located i) shortly upstream of the mine water discharge point into the River Bursk, ii) shortly downstream of the discharge point in the vicinity of monitoring point CP1, iii) approximately 400 m further downstream in the vicinity of monitoring point D4-SW3, and iv) between Bursk Lough and Rahans Lough approximately 150 m downstream of a local road bridge in the vicinity of monitoring point D4-SW5. The sample site in the River Glyde was originally planned to be shortly upstream of the confluence of the Bursk and Glyde, but owing to unsuitably deep water at this location the sample site was moved approximately 900 m upstream near Tobermannan Bridge. Originally there were intended to be a further three sample sites on the River Glyde (just downstream of the confluence, and upstream and downstream of Ballyhoe Lough pNHA, including the vicinity of monitoring point D1-SW12), but none of these three locations could be sampled owing to excessive water depth and unsuitable silty substrate.

6.2.5 Ecological Impact Assessment Methodology

The method employed for assessment of impacts on ecological features is that recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM) in *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018). CIEEM is the leading professional membership body for ecologists in both the UK and Ireland. It provides advice to government upholds standards in professional conduct and promotes best practice. Guidance in CIEEM (2018) broadly agrees with guidance in EPA (2017) and guidance issued by National Roads Authority (NRA, 2009 (now TII) – this guidance is commonly used in Ireland and provides detail on the use of a geographical scale of importance, which broadly concurs with CIEEM guidance).

Determination of Sensitive Features

An ecological feature is a site, habitat, or species with nature conservation importance. Only those ecological features that are 'important' and could be significantly affected by the project require detailed assessment – “it is not necessary to carry out detailed assessment of ecological features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable” (CIEEM, 2018). This is consistent with the EIA Directive (Directive 2011/92/EU as amended by Directive 2014/52/EU) which requires investigation of *likely significant effects*, as accordingly emphasised by EPA (2017).

Consideration was given to a range of factors in order to determine the importance of ecological features and to provide a robust rationale for their inclusion within detailed assessment. Such factors include:

- Rarity, endemism, mobility and geographic range (particularly if this changing)
- Size / extent, rate of decline and vulnerability
- Typicality, species-richness, habitat diversity and connectivity / fragmentation
- Value to other features (e.g. habitat which supports notable species or buffers against impacts) and,
- Potential for restoration.

Existing data and criteria are considered when determining the importance of ecological features. Where these are lacking, it is necessary to apply professional judgement.

Requirements to comply with legislation are stated during the assessment, but legislative protection and priority listing does not necessarily translate to importance. For example, a transitory roost of a single bat would not be afforded the same importance as a regularly-occurring maternity roost (although legal obligations must still be met), and areas of priority habitat could be unfavourably small or in poor condition and not practically restorable.

The importance of ecological features is described within a geographic scale. The adopted scale of importance is shown in Table 6-1, and is based on guidance provided by CIEEM (2018) and the National Roads Authority (NRA, 2009; now TII). For the purposes of this assessment 'Local' is the area within 5 km of the mine site.

Table 6-1 Scale of Importance of Ecological Features

Importance ¹	Examples
International (Very high)	Internationally designated nature conservation site (or candidate / proposed international site), or site satisfying criteria for such designation, or feature essential to maintaining such sites. Sustainable area (or part of a larger sustainable area) of best examples of Annex I habitat ² . A regularly-occurring internationally-significant population (e.g. 1% of the national population, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of internationally important species listed on Annex I of the Birds Directive ³ or Annex II of the Habitats Directive.
National (High)	Nationally designated nature conservation site (or proposed such site), or site satisfying criteria for such designation. Sustainable area of good quality Annex I habitat not deemed to be of international importance, or of national priority habitat, which is a significant proportion of the resource. Regularly-occurring nationally significant population (e.g. 1% of the national population, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of species listed or protected under the Wildlife Acts or Red Data lists, or site supporting one.
County (Medium)	County designated nature conservation site (or proposed such site). Sustainable area of Annex I habitat or national priority habitat not deemed to be of higher importance (e.g. lower quality, highly fragmented, small and / or low restoration potential), or priority habitat under a Local Biodiversity Action Plan if this exists and applies at county level. Regularly-occurring county significant population (e.g. 1% of county resource, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of species listed or protected under the

Importance ¹	Examples
	Habitats / Birds Directives, Wildlife Acts, Red Data lists or Local Biodiversity Action Plan (if this exists and applies at county level), or site supporting one.
Local (Local higher)	Priority habitat of insufficient size or quality for higher importance, or degraded with low restoration potential. Habitat providing significant biodiversity or important ecological corridors in a local context. Small sustainable population of notable species not qualifying for higher importance or uncommon locally.
Site (Local lower)	Common, heavily-managed or modified habitat, and common and widespread species.

¹ Using a geographical scale as recommended by CIEEM (2018). Terms in brackets are those correspondingly used by NRA (2009).

² Habitat listed on Annex I of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

³ Bird species listed on Annex I of Directive 2009/147/EC on the conservation of wild birds.

Describing Potential Effects

Effects are typically considered for the construction, operation and decommissioning phases of a development. For the Proposed Licence Amendment, the mine water discharge point already exists and there is no construction phase, and it is assumed that the discharge will continue for the lifetime of the mine.

Under CIEEM (2018) guidance there is an important distinction between impact and effect. An impact is an action on an ecological feature (e.g. hedgerow removal; loss of a bat roost). An effect is the outcome of that impact on an ecological feature (e.g. effect of hedgerow loss on breeding birds; effect of bat roost loss on the conservation status of the bat species). Impacts may be direct or indirect (also termed 'secondary'). Direct impacts are attributable to an action associated with a development. Indirect impacts are often produced away from a development or as a result of other initial impacts.

Likely impacts and effects are characterised using those parameters below that are necessary to understand the particular ecological effect:

- Direction – whether the impact will have a beneficial, neutral or adverse effect
- Magnitude – the 'size', 'amount' or 'intensity' of an impact, described in quantitative terms as far possible
- Extent – the spatial or geographical area or distance over which the impact or effect occurs
- Duration – the time over which an effect is expected to last prior to recovery or replacement (if possible) of the feature. Where appropriate, ecological aspects such as lifecycles are considered. The duration of an effect may be longer than the duration of an activity or impact
- Timing and frequency – timing is important since an effect might not occur if critical seasons or life stages are avoided. Frequency considers repetition of an activity, which may result in a greater effect, and
- Reversibility – whether the effect is temporary or permanent. A temporary effect is one from which recovery is possible or for which effective mitigation is possible and enforceable. A permanent effect is one from which recovery is either not possible, or cannot be achieved within a reasonable timescale (in the context of the feature being assessed).

Significance of Effect

An effect (positive or negative) is significant at a specified geographical level if it affects the ecological integrity of a site or ecosystem or the conservation status of a species or habitat. If not significant at the level it was considered important, an effect could be significant at a lower geographic level (for example, an effect on a nationally-important population may not be significant to the national population). These assessments are based on quantitative evidence where possible, and as necessary through professional judgement.

In assessing effects on the integrity of sites, consideration is given to conservation objectives, whether processes within them will be altered, effects on habitats and species population size / viability, and whether these will have an effect on conservation status. Conservation status includes the abundance and distribution of species, and the extent, structure and function, and typical supported species of habitats.

Initially, the effect significance does not consider mitigation (avoidance or reduction) or compensation measures. The residual effect significance takes such measures into account, with the aim that, wherever possible, residual effects are not significant or are significant at a lower geographic level than the unmitigated effects.

Consideration was also given to cumulative effects, since effects acting in combination may have a cumulative impact exceeding that of the separate effects. Cumulative effects may arise from a combination of effects from the Proposed Licence Amendment itself (e.g. effects at the construction and operation stages), or the combined effects from different developments.

6.2.6 Limitations and Assumptions

Desk study information is dependent upon people and organisations having submitted records for the area of interest. As such, a lack of records for particular habitats or species does not necessarily mean that they are absent from the study area. Likewise, the presence of records for particular habitats and species does not automatically mean that these still occur within the area of interest or are relevant to the Proposed Licence Amendment.

No field surveys were carried out directly by AECOM for this assessment. The assessment was based on desk-based research, which included use of reports for previous surveys and the report for a macroinvertebrate survey carried out in July 2020, produced by third parties and supplied to AECOM.

6.3 Existing Environment & Baseline Information

6.3.1 Designated Sites – Statutory Designations

The mine site and factory site do not lie within or near any statutory site designated for nature conservation.

There are no European sites within 15 km of the mine site and there are no nationally designated sites within 2 km of the mine site. However, there are three statutory European sites and three statutory nationally designated sites that are hydrologically connected to and downstream of the mine effluent from both the mine site and factory site.

There are also five statutory nationally designated sites that are not directly impacted by the mine effluent because they are located in upstream tributaries of the River Glyde, but they are designated for species that may consume mobile aquatic species (e.g. birds that prey on fish). No other statutory designated sites are known to be hydrologically-connected to the mine water discharge.

These statutory designated sites are listed in Table 6-2 (in order of increasing distance from the mine site, except for the five upstream pNHAs which are listed last) with summarised reason(s) for designation and relationship to the mine site. They are displayed on the map in Volume 3, Appendix A.6.2 Figure A4-1.

Table 6-2 Statutory Designated Sites with Connectivity to the Mine Site

Designated Site [site code]	Reason(s) for Designation	Relationship to the Mine Site
Ballyhoe Lough pNHA [001594]	Ballyhoe Lough pNHA is located on the Co. Monaghan / Meath border and its features of interest include bog, acid peaty lake, wet grassland and birds (An Taisce, 2009). It is a fairly acid, peaty lake that is divided by a narrow section of wetland dominated by willow <i>Salix</i> spp. trees, common reed <i>Phragmites australis</i> and alder <i>Alnus glutinosa</i> . Common reed is present around the lake edge with occasional club rush <i>Scirpus lacustris</i> and white water-lily <i>Nymphaea alba</i> (Monaghan County Council, 2018; NPWS, 2009). The lake also supports pike <i>Esox lucius</i> , bream <i>Abramis brama</i> , roach <i>Rutilus rutilus</i> , rudd <i>Scardinius erythrophthalmus</i> , perch <i>Perca</i> spp., tench <i>Tinca tinca</i> and European eel <i>Anguilla anguilla</i> (a critically endangered species under International Union for the Conservation of Nature (IUCN)) criteria (www.iucnredlist.org/species/60344/45833138).	There is direct hydrological connectivity from the mine site and factory site, with the River Glyde entering Ballyhoe Lough approximately 4.5 km downstream of the mine discharge.
Killyconny Bog (Cloghbally) SAC [000006]	The qualifying interests are the following Annex I habitats: Active raised bog [7110] and Degraded raised bog still capable of natural regeneration [7120]. It is located on the Co. Cavan / Meath border and is of conservation value as one of the largest areas of relatively intact active raised bog remaining in north-eastern Ireland.	This SAC is 13.2 km south-west of the factory site, but is more than 15 km from the mine site. It is in the Boyne WFD Catchment (catchment ID: 07), which is a different one to the factory site and mine site, therefore there is

Designated Site [site code]	Reason(s) for Designation	Relationship to the Mine Site
		considered to be no connectivity to this SAC.
Stabannan-Braganstown SPA [004091]	Stabannan-Braganstown SPA is a small, flat alluvial plain designated for greylag goose <i>Anser anser</i> [A043].	There is direct hydrological connectivity from the mine site and factory site to this SPA via the River Bursk and hence the River Glyde. The River Glyde runs along part of the north edge of this SPA, 27.5 km downstream from the mine site
Stabannan-Braganstown pNHA [000456]	Stabannan-Braganstown pNHA was designated for birds (An Taisce, 2009).	There is hydrological connectivity from the mine site and factory site to this SPA via the River Bursk and hence the River Glyde. The Stabannan-Braganstown SPA lies within the pNHA and the River Glyde flows within the pNHA approximately 27.5 km downstream from the mine site.
Dundalk Bay SPA [0004026] and Ramsar site	Dundalk Bay SPA is a large shallow sea bay with salt marshes and intertidal sandflats and mudflats that are designated for several wetland and waterbirds which include: • Great crested grebe <i>Podiceps cristatus</i> [A005] • Greylag goose [A043] • Light-bellied Brent goose <i>Branta bernicla hrota</i> [A046] • Shelduck <i>Tadorna tadorna</i> [A048] • Teal <i>Anas crecca</i> [A052] • Mallard <i>Anas platyrhynchos</i> [A053] • Pintail <i>Anas acuta</i> [A054] • Common scoter <i>Melanitta nigra</i> [A065] • Red-breasted merganser <i>Mergus serrator</i> [A069] • Oystercatcher <i>Haematopus ostralegus</i> [A130] • Ringed plover <i>Charadrius hiaticula</i> [A137] • Golden plover <i>Pluvialis apricaria</i> [A140] • Grey plover <i>Pluvialis squatarola</i> [A141] • Lapwing <i>Vanellus vanellus</i> [A142] • Knot <i>Calidris canutus</i> [A143] • Dunlin <i>Calidris alpina</i> [A149] • Black-tailed godwit <i>Limosa limosa</i> [A156] • Bar-tailed godwit <i>Limosa lapponica</i> [A157] • Curlew <i>Numenius arquata</i> [A160] • Redshank <i>Tringa totanus</i> [A162] • Black-headed gull <i>Chroicocephalus ridibundus</i> [A179] • Common gull <i>Larus canus</i> [A182] • Herring gull <i>Larus argentatus</i> [A184] • Wetland and waterbirds [A999]	There is direct hydrological connectivity from the mine site and factory site to Dundalk Bay via the River Bursk, the River Glyde and the River Dee. The River Dee enters Dundalk Bay 38.6 km downstream of the mine site.
Dundalk Bay SAC [000455]	Dundalk Bay SAC is designated for the following QI habitats: • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Perennial vegetation of stony banks [1220] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) [1330] • Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]	There is direct hydrological connectivity from the mine site and factory site to Dundalk Bay via the River Bursk, the River Glyde and the River Dee. The River Dee enters Dundalk Bay 38.6 km downstream of the mine site.
Dundalk Bay pNHA [000455]	There is no site synopsis or designation information available for Dundalk Bay pNHA. It coincides with Dundalk Bay SAC and SPA.	There is direct hydrological connectivity from the mine site and factory site to Dundalk Bay via the River Bursk, the River Glyde and the River Dee. The River Dee enters Dundalk Bay 38.6 km downstream of the mine site.

Designated Site [site code]	Reason(s) for Designation	Relationship to the Mine Site
Breakey Loughs pNHA [001558]; Corstown Loughs pNHA [000552]; Monalty Lough pNHA [001608]; Lough Naglack pNHA [000561]; Lough Fea Demesne pNHA [000560]	These pNHAs are considered together because connectivity and potential effects are the same for each one and are limited to that described to the right. They are designated for various habitats including calcareous and other loughs, calcareous and other marsh, calcareous and other grassland, limestone, caves and bog. More importantly for this assessment they are all also designated for 'birds' or 'waterfowl', which are generally not specified except for heron <i>Ardea cinerea</i> at Lough Naglack.	There is hydrological connectivity from the mine site to these pNHAs, but they will not be directly impacted by the mine water discharge because there are on upstream tributaries of the River Glyde beyond the downstream confluence with the River Bursk. These pNHAs are also upstream of a confluence of the River Glyde and smaller tributary such that the factory site cannot directly affect them. The designated avian interests include waterfowl and heron, some of which in addition to heron are likely to prey on migratory fish species.

6.3.2 Designated Sites – Non-Statutory Designations

There are no non-statutory designations for nature conservation within 2 km of the mine site or factory site.

6.3.3 Non-designated Freshwater Habitat

The primary habitat of concern is the river system into which the discharge from the mine and factory sites flow. This includes the River Bursk (EPA name: Lurgans), the River Glyde, and three loughs along the routes of the River Bursk and River Glyde. One of the loughs, Ballyhoe Lough, is a pNHA, located 4.5 km downstream from the mine water discharge point and is described in Section 6.3.1.

Bursk Lough is located 1.2 km downstream of the discharge point and freely-available aerial photography between 2000 and 2020 suggests that the small lough is heavily vegetated and may be categorised as swamp or marsh habitat. Historical imagery from OSI suggests that Bursk Lough has existed since at least 1842.

Rahans Lough is located 2.2 km downstream of the discharge point and Foss and Crushell (2008) consider it to be a candidate NHA (cNHA). It has not been accepted as a pNHA or NHA according to the NPWS website. It is a 34.9 ha elongated mesotrophic lake with widespread areas of floating macrophytes and reed communities along the edges. Relevant habitats on site include wet grassland (Fossitt habitat code GS4), mesotrophic lake (FL4), reed and large sedge swamps (FS1), drainage ditches (FW4), and wet willow-alder-ash woodland (WN6). The reed zone mainly comprises common club-rush *Schoenoplectus lacustris*, bulrush *Typha latifolia* and common reed *Phragmites australis*. The floating macrophyte zone mainly comprises yellow water-lily *Nuphar lutea*, and pondweeds *Potamogeton* spp. across a majority of the open-water. Recreational fishing also occurs at this lake, with an intensity rated as low (Foss and Crushell, 2008).

This river system flows through a highly agricultural landscape, and nutrient pollution from agriculture is a known issue (EPA, 2020). The waters of the River Glyde discharge into Dundalk Bay which includes estuarine and other coastal habitats covered by the Dundalk Bay SAC (see Section 6.3.2).

The river system that mine and factory site water discharges into is located in the Glyde_030 waterbody, which currently is reported to be in overall good River Waterbody Water Framework Directive (WFD) status (2013 – 2018) according to the EPA. In accordance with Article 5 of the EC Environmental Objectives (Surface Waters) Regulations 2009 (SI 272 of 2009), the existing good condition of this waterbody should not be deteriorated (EPA, 2018; IFI, 2019).

The upper and middle reaches of the Glyde are generally reported to have good ecological status with one site at Lagan Bridge (ITM 687379 796478) having high ecological status (EPA, 2020). The Lagan Bridge site is located approximately 8.4 km downstream from the mine water discharge point and is downstream of Ballyhoe Lough and monitoring point D1-SW12. However, water quality in the lower reaches of the Glyde appears to be deteriorating and exhibits unsatisfactory conditions (EPA, 2020).

Agriculture negatively affects most of the at-risk waterbodies in the Newry-Fane-Glyde-Dee catchment (KD Environmental Ltd, 2019; EPA, 2018). Based on aerial imagery and the Corine 2018 land use values on the EPA maps website, a sizeable agricultural landscape surrounds the River Bursk and Glyde, both upstream and downstream of the mine water discharge point in the River Bursk and Glyde. Therefore, pollution from agricultural run-off, such as pesticides and nutrients (mainly nitrogen, phosphorus, and potassium), impacts these watercourses. Other pressures in the Glyde catchment include hydromorphological pressures, urban wastewater, industry, and forestry (EPA, 2018).

6.3.4 Protected and Notable Species

Fish

The River Bursk and River Glyde support the following notable species that may be affected by the mine water: Atlantic salmon *Salmo salar* and brook lamprey *Lampetra planeri* (both Habitats Directive Annex II, requiring establishment of SACs for their protection and indicating importance on a European scale), brown trout *Salmo trutta*, and European eel (critically endangered by IUCN criteria). A variety of other species that are not protected or notable are also present, known to include perch *Perca fluviatilis*, pike *Esox lucius*, roach *Rutilus*, stone loach *Cobitis elongatoides* and three-spined stickleback *Gasterosteus aculeatus* in the watercourses, and also bream *Abramis brama* and tench *Tinca tinca* at Rahans Lough. Within the desk study search area for the factory site, but not the mine site, there are also records of rudd *Scardinius erythrophthalmus*. The upper reaches of the River Bursk are reported to contain salmonid spawning and nursery habitat. However, downstream of the mine water discharge point there is reported to be cyprinid and coarse fish habitat but no salmonid spawning and nursery habitat (IFI, 2019; SLR, 2019d).

All the notable fish species (salmon, trout, lamprey and European eel) are migratory species, meaning they migrate up and downstream to complete their life cycle, and therefore connectivity between spawning, feeding and refuge habitat is important.

The electrofishing survey carried out by SLR (2019d) on 28 August 2019 identified brown trout, European eel, brook lamprey, stone loach, perch, and three-spined stickleback upstream of the mine water discharge. At the mine water discharge point itself, European eel, roach and perch were recorded; whilst 70 m downstream at Compliance Point CP-1 brown trout and perch were recorded. At D4-SW5 in the River Bursk (1.7 km downstream of the discharge point) perch and pike were recorded. Downstream in the River Lagan / Glyde the water was too deep to carry out electrofishing.

An IFI 2010 fish survey recorded Atlantic salmon upstream of Lough Fea in Derrylavan, which is 4.5 km upstream of the mine water discharge point. However, Atlantic salmon was not recorded during the electrofishing survey in 2019 (SLR, 2019d). Nevertheless, the salmon holding capacity in the upstream River Bursk was considered to be moderate and there was good nursery and moderate spawning habitat at the Derrylavan site (4.5 km upstream of the discharge point), nearby crossroads 8 km upstream from the discharge point, and at Tirnadrola (9.6 km upstream from the discharge point) (SLR, 2019d).

Ballyhoe Lough (nationally-designated pNHA) and Rahans Lough are located approximately 4.5 km and 2.2 km, respectively, downstream of the discharge point, and are both hydrologically connected to the mine site and factory site. They both support fish species including roach, bream, tench, perch, and pike (IFI, 2019).

Aquatic Macroinvertebrates – Desk Study

No protected aquatic macroinvertebrates were recorded within 5 km of the mine discharge point in the NBDC database or within the 10 km grid N89 from the requested NPWS rare and protected species dataset. A similar search based on the factory site found records (most recently from 2006) of freshwater white-clawed crayfish *Austropotamobius pallipes*, however these records were all in a different sub catchment to the factory site and are not therefore relevant here.

Macroinvertebrate sampling at four kick sampling locations in the River Bursk and Glyde recorded pollution sensitive (group B) species, such as caddisflies (Limnephilidae family) (KD Environmental Ltd, 2019).

The Q biological rating (determined from macroinvertebrate sampling results, where higher rating indicates higher water quality) directly upstream and 70 m downstream of the mine water discharge point in the River Bursk decreased from Q3-4 in June 2018 (before mine water management change), to Q3 in June 2019 (after mine water management change). The Q biological ratings indicated that the water at these sampling locations had a WFD status of 'moderate' and was considered slightly polluted in June 2018, whilst in July 2019, the WFD status was

'poor' and considered moderately polluted. Based on these results, the River Bursk at Compliance Point CP-1 is in an unsatisfactory condition (KD Environmental Ltd, 2018; KD Environmental Ltd, 2019; EPA, 2020).

The Q biological rating in the River Bursk located 1.6 km downstream of the discharge point before reaching Rahans Lough was scored as Q4-5 in July 2019, which is considered to indicate a WFD Status of high with unpolluted waters. The Q biological rating of the River Glyde located 5.1 km downstream of the discharge point was scored as Q3, which is considered to indicate a WFD status of poor with moderately polluted waters (KD Environmental Ltd, 2019; EPA, 2020). The scheduled invasive species zebra mussel *Dreissena polymorpha* was recorded within Rahans Lough in 2007 according to the NBDC database.

However, a very recent macroinvertebrate field survey was carried out on the River Bursk and nearby Glyde in 2020, and is discussed further below.

Macroinvertebrate sampling was also previously carried out in the vicinity of the factory site, in 2019 (KD Environmental Ltd, 2019) and 2018 (KD Environmental Ltd, 2018). However, the tabulated macroinvertebrate numbers in these reports frequently disagree significantly with the provided summary totals, percentages and pie charts. The summary totals and percentages usually agree, and where they agree they have been assumed to be correct, however there are some summary totals and percentages that are in disagreement. These surveys included seven sample sites upstream of the factory site (Sites 1 to 5) and two 10 m and 20 m downstream of it (Sites 6 and 7) in 2019, and one less in 2018. Table 6-3 below shows the percentages of each macroinvertebrate indicator group at each of the seven sample sites.

Table 6-3. Percentages of macroinvertebrate groups near factory site (KD Environmental Ltd; first % = 2018, second % = 2019, '-' = no survey, '?' = stated totals / percentages inconsistent)

Indicator group	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Group A (very sensitive)	0, 0	0	-, 0	?, 0	0, 0	0, 0	0, 0
Group B (moderately sensitive)	0, 3	6	-, 0	?, 0	0, 0	2.1, 0	8.6, 0
Group C (moderately tolerant)	100, 97	89.2, 88	-, 82	?, 95	91.3, 100	95.8, 66	91.4, 78
Group D (very tolerant)	0, 0	8.1, 6	-, 18	?, 5	0, 0	0, 34	0, 18
Group E (most tolerant)	0, 0	2.7, 4.2	-, 0	?, 0	8.7, 0	2.1, 0	0, 4

The above data demonstrated Q values of Q2-3 or Q3, indicating a WFD status of poor (moderately polluted). The majority (in a few cases all) of the sampled invertebrates were Group C taxa, much like the recent River Bursk samples (see below), and it is likely that agricultural run-off is the main cause. The samples are fairly similar with some variation, including an increase in more pollution-tolerant taxa around Site 3 in 2019, which is upstream of the factory site and therefore not affected by it. However, much more noticeable is a substantial drop in moderately tolerant taxa in 2019 at Site 6 (10 m downstream of the factory site discharge), accompanied by an apparently corresponding dramatic increase in Group D very tolerant taxa. This does not seem to have occurred in 2018 but suggests that there may at times be an adverse effect from the factory site discharge. However the data also suggest substantial recovery within only 20 m from the discharge at Site 7. This in turn may suggest that the factory site discharge is less significant than the mine site discharge (see discussion of the sampling for the latter in the following paragraphs).

Aquatic Macroinvertebrates – Field Survey

The Q value derived from analysis of macroinvertebrate samples at all sites sampled in July 2020 (Flynn Furney Environmental Consultants, 2020) was Q3, indicating a WFD status of poor (moderately polluted). It will be noted that this largely agrees with previous surveys conducted after the change in mine water management and described in the previous paragraphs, but differs from the reported good status of the River Glyde, although this might be because these samples are in a relatively small part of the Glyde catchment.

Five of the originally-proposed eight sample sites could be sampled (see methodology above), including all four of the River Bursk sample sites and one amended River Glyde sample site upstream of the Bursk / Glyde confluence near Tobermannan Bridge. The latter sample site cannot be affected by the mine water discharge, but will be affected by any discharge from the factory site. However, the first sample site in the River Bursk was upstream of the mine water discharge point and could not be affected either the mine or factory site, suggesting that wider

environmental pollution (probably agricultural run-off) is the main factor affecting the macroinvertebrate populations.

However, inspection of the macroinvertebrate analysis results in more detail provides further information. Table 6-4 shows the percentages of each indicator group at each of the sample sites.

Table 6-4. Percentages of macroinvertebrate groups near and downstream of mine site (Flynn Furney Environmental Consultants, 2020)

Indicator group	Site 1 (upstream of discharge)	Site 2 (near CP1)	Site 3 (near D4-SW3)	Site 4 (near D4-SW5)	Site 5 (R. Glyde above confluence)
Group A (very sensitive)	0	0	0	0	0.5
Group B (moderately sensitive)	6.96	0.7	0.5	1.7	2.4
Group C (moderately tolerant)	92.5	93	92	96.8	94
Group D (very tolerant)	0.5	6	7.4	1.4	0

Whilst moderately tolerant taxa dominant the samples, a few more observations can be made about this data:

- There are no very sensitive taxa in the River Bursk samples (Sites 1 to 4), including Site 1 which is unaffected by either the mine or factory site discharges. However, a very small proportion of very sensitive taxa were present at Site 5 in the River Glyde upstream of the confluence with the River Bursk, which would be affected by the factory site but not the mine site and might indicate a lesser degree of effect from the factory site, and
- Very tolerant taxa were present in very small quantity (0.5%) at Site 1 (which is unaffected by the mine or factory sites), but this amount increases twelvefold or more downstream of the mine water discharge at Site 2 (near CP1) and Site 3 (near D4-SW3). The amount then drops substantially but is moderately higher than Site 1 at Site 4 (near D4-SW5), which is between Bursk Lough and Rahans Lough.

It must be stressed that there is insufficient data here to analyse statistically, and that there may be factors resulting in the above observations other than the mine water discharge. However, the above observations are suggestive that a) the mine water discharge is having a degree of adverse effect on macroinvertebrate populations in the River Bursk on top of likely stronger agricultural run-off effects, b) they are partly recovered from possible mine water effects between Bursk Lough and Rahans Lough, c) substantial dilution following confluence with the River Glyde is likely to greatly reduce mine water discharge effects on macroinvertebrates, and d) there is probably less of an effect on macroinvertebrates from factory site discharges into the River Glyde, because Site 5 in the River Glyde upstream of the confluence with the River Bursk was the only sample containing any very sensitive taxa, and the previous sampling at the factory site (see above) suggests that possible adverse effects from the factory site discharge may be quickly ameliorated and / or temporary.

Plants

There are no notable or protected aquatic plants in the NBDC records within 5 km of the mine water discharge point or within the 10 km grid N89 from the requested NPWS rare and protected species dataset.

There are NBDC records of the near-threatened (Ireland Red List) grass species smooth brome *Bromus racemosus* within 5 km of the mine water discharge point. Smooth brome is a much-declined annual species of unimproved hay-and water-meadows, usually on damp periodically flooded alluvial soils (<https://www.brc.ac.uk/plantatlas/plant/bromus-racemosus>). Whilst it could potentially exist on those margins of the river system lacking dominance of shrubs and trees, it is unlikely to occur given that the surrounding land is subject to heavy agricultural management. There are records on the NBDC database of five scheduled invasive plant species within 5 km of the mine water discharge point and / or factory site, which include Canadian waterweed *Elodea canadensis*, Himalayan balsam *Impatiens glandulifera*, Japanese knotweed *Reynoutria japonica*, salmonberry *Rubus spectabilis* and rhododendron *Rhododendron ponticum*.

The same searches carried out for the factory site found records of a red-listed moss, *Bartramia ithyphylla*. However, this species grows in rock crevices or occasionally hedgebanks, with no association with water, and is therefore not considered relevant here.

Otter

There are NBDC records of otter (listed in Annex II and IV of the Habitats Directive and protected under the Wildlife Acts) approximately 1.5 km south-east of the discharge point north of Rahans Lough, and approximately 8.4 km downstream of the confluence of the River Bursk with the River Glyde, by Lagan Bridge. There were also six records of otter in 1980 within the 10 km grid reference N89 from the NPWS rare and protected species dataset, and a further two records within the desk study search area for the factory site. Additionally, an otter spraint was found upstream near Carrickmacross during the 2019 River Bursk fish survey (SLR, 2019d), and otters are generally considered widespread in Ireland. The home range of otters is large (where the habitat is primarily linear, studies summarised in Chanin (2003) have found home ranges of approximately 15-30 km of watercourse, and potentially considerably more for males), therefore in combination with the reported records it is reasonable to assume that otters utilise the entire length of the River Bursk and River Glyde, and the scattered loughs along them.

Kingfisher

There are NBDC records for kingfisher listed as Annex I in the Birds Directive and Amber listed in the Birds of Conservation Concern in Ireland (BoCCI) within the 10 km grid (N89) that the mine water discharge point and factory sites are located. Kingfisher has been recorded downstream of the discharge point on the western edge of Rahans Lough during Irish Wetland Birds Surveys (I-WeBS) between 1994 and 2001. Information in Forrester (2007) states that kingfishers prefer small watercourses of 3-5 m width with slow flowing water, high vertical banks of excavatable substrate for nest burrows, perches for fishing and small fish prey. Fish prey includes sticklebacks – whilst three-spined stickleback was only recorded upstream of the discharge point during the fish survey (SLR 2019d), it is clear from the above-noted record at Rahans Lough that small fish prey must exist there and it is reasonable to assume that they will also be present in at least part of the connected River Bursk, which is potentially suitable for kingfisher by the other above criteria. Territory size is likely to be in the order of 1-3 km of watercourse based on information in Forrester (2007). Therefore, kingfisher is likely to utilise at least part of the River Bursk downstream of the discharge point, as well as the River Glyde.

Bats

There are several bat species within 5 km of the mine water discharge point and / or factory site (common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Nathusius's pipistrelle *Pipistrellus nathusii*, Leisler's bat *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri* and Daubenton's bat *Myotis daubentonii* – all bats are European Protected Species). Given that land adjacent to the River Bursk and River Glyde is mostly heavily agricultural (pasture and arable land), and that water features and riparian vegetation in contrast offer valuable insect foraging resources for bats, it is reasonable to assume that most if not all of above bat species will forage along the River Bursk / Glyde downstream of the discharge point, and are also likely to commute along these linear features.

Amphibians

There are three records of common frog *Rana temporaria* (protected under the Wildlife Acts) within 5 km of the mine water discharge point and factory site in the NBDC database. There were also seven records of common frog between 2002 and 2011 within the 10 km grid N89 from the NPWS protected and rare species dataset. Common frog may forage and breed within the river system downstream of the mine site but is most likely to occur in pooled water and associated marshland such as occurs at the loughs through which the River Bursk and River Glyde pass.

6.3.5 Water Quality in the River Bursk and River Glyde

The mine water discharge contains calcium sulphate, as does the discharge from the factory site. Sulphate is the primary pollutant concern, but calcium is potentially relevant, and both affect conductivity. Impact assessment carried out in October 2018 using data from monitoring at points in the River Bursk and Glyde determined that the only parameters that would exceed their limits under licence due to the mine water discharge were sulphate and conductivity at Compliance Point CP-1 (SLR, 2019c; SGCPIL, 2020). However, sulphate, calcium and conductivity can affect ecological features. Therefore, existing sulphate, calcium and conductivity levels are important.

Note that, following the change in mine water management in September 2018, the mine water discharge is already discharging into the River Bursk at a rate that is expected to continue similarly in future, and as such the discharge rate of the Proposed Licence Amendment already exist. The situation for the EIA is therefore unusual in that the

baseline conditions since September 2018 already incorporate the discharge rate of the Proposed Licence Amendment.

There are several water quality monitoring points along the River Bursk and River Glyde, all except MSE-1 downstream of the mine water discharge and the last two also downstream of the factory site (Volume 3, Appendix A.6.2, Figure A4-2), which comprise:

- MSE-1: the mine water holding tank before it enters into the River Bursk mine water discharge point via an underground discharge line
- CP-1: 70 m downstream of the mine water discharge point and located in the River Bursk
- D4-SW3: 270 m downstream of the mine water discharge point and located in the River Bursk before Bursk Lough
- D4-SW5: 1.7 km downstream of the mine water discharge point and located in the River Bursk between Bursk Lough and Rahans Lough
- D1-SW12: 5.6 km downstream of the mine water discharge point and located in the River Glyde downstream of Ballyhoe Lough; note that because this monitoring point is in the River Glyde it necessarily also receives any discharge from the factory site as well as the mine site, and
- D1-SW16: 16 km downstream of the mine water discharge point and located in the River Glyde upstream of the Tallanstown drinking abstraction point; note that because this monitoring point is in the River Glyde it necessarily also receives any discharge from the factory site as well as the mine site.

There is also a water quality monitoring point in the River Bursk 2.2 km upstream of the discharge point (D4-SW1).

Note that the confluence of the River Bursk with the River Glyde is approximately 2.3 km downstream of the discharge point.

Sulphate

Sulphate concentrations in the River Bursk and River Glyde discussed in this section originate from measured concentrations, rather than being derived from other parameters such as conductivity.

Following the change in mine water management in September 2018, sulphate concentrations at Compliance Point CP-1 in the River Bursk (70 m downstream of the mine water discharge point) have exceeded the compliance limit of 200 mg/L between October 2018 and January 2020 (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 1). Although sulphate is not regulated under the EC Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) and European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), 200 mg/L is the limit for groundwater sulphate levels stated in an Interim Report by the EPA (2003), which sets guideline values for the protection of groundwater in Ireland.

The maximum sulphate concentration recorded between October 2018 and January 2020 at Compliance Point CP-1 was 998 mg/L on 28 October 2018, which exceeds the drinking water standard of 250 mg/L and the limit for groundwater sulphate levels of 200 mg/L given in EPA (2003). The minimum sulphate concentration at Compliance Point CP-1 during this time period was 25 mg/L sulphate on 09 July 2019, but this contrasts drastically with the other thirteen samples taken in July 2019, which ranged from 310 mg/L to 782 mg/L sulphate. The particularly low sulphate level on 09 July 2019 appears anomalous and the much higher levels recorded at other times in July 2019 are more likely to be typical, given that river water levels are typically low in the summer and thus sulphate concentration would be expected to be higher. The mean sulphate concentration across all samples taken during this period at Compliance Point CP-1 was 340 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 1).

Approximately 2.2 km upstream of the mine water discharge point in the River Bursk at sampling point D4-SW1, sulphate concentrations between October 2018 and January 2020 ranged from 13 mg/L to 84 mg/L, with mean sulphate concentration of 27 mg/L (SGCPIL, 2020).

At monitoring point D4-SW3 (270 m downstream of the discharge point) and D4-SW5 (1.7 km downstream of the discharge point) in the River Bursk, the sulphate concentrations were typically similar to those at Compliance Point CP-1. The mean sulphate concentration at D4-SW3 in October 2018 was 787 mg/L, the minimum concentration recorded was 549 mg/L and the maximum was 976 mg/L. The mean sulphate concentration at D4-SW5 between October 2018 and December 2018 was 490 mg/L, the minimum concentration recorded was 117 mg/L, and the maximum was 957 mg/L (Volume 3, Appendix A.6.3, Graph 1).

Sulphate concentrations 5.6 km downstream of the discharge point at D1-SW12 in the River Glyde between October 2018 and October 2019 were 113 mg/L on average. The minimum sulphate concentration recorded was 21 mg/L and the maximum was 286 mg/L at D1-SW12 during this period (Volume 3, Appendix A.6.3, Graph 1).

Sulphate concentrations have not exceeded the drinking water standard of 250 mg/L, nor the limit for groundwater sulphate levels of 200 mg/L in EPA (2003), at monitoring point D1-SW16 in the River Glyde, approximately 16 km downstream of the mine water discharge point and 2 km upstream of the drinking water abstraction point in Tallanstown. Mean sulphate concentration at D1-SW16 between October 2018 and October 2019 (which is since the change in water management and includes summer low river flow conditions) was 76 mg/L and ranged from 25 mg/L to 180 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 1).

Water hardness influences the toxicity of sulphate, with toxicity typically reduced with increasing water hardness. Mean water hardness at D4-SW1 (2.2 km upstream of the mine water discharge point) between October 2018 and January 2020 was 133.9 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 2).

Calcium

Calcium is not regulated under the EC Environmental Objectives (Surface Waters) Regulations 2009 (SI 272 of 2009) and European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), but 200 mg/L is the limit for groundwater calcium levels stated in an Interim Report by the EPA (2003).

Calcium concentrations exceeded the limit for groundwater calcium levels of 200 mg/L in EPA (2003) at Compliance Point CP-1 in the River Bursk between October 2018 and October 2019. The mean calcium concentration at Compliance Point CP-1 was 140.2 mg/L and ranged from 7 mg/L to 426 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 3).

Upstream of the mine water discharge in the River Bursk at D4-SW1, the mean calcium concentration between October 2019 and January 2020 was 41.4 mg/L and ranged from 3 mg/L to 119 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 3). Note that water hardness is not only a function of calcium level; hence the level of water hardness discussed within the sulphate section of Section 6.3.5 is different.

Downstream of the mine water discharge in the River Bursk at D4-SW3 and D4-SW5 calcium concentrations were typically similar to those at Compliance Point CP-1. The mean calcium concentration at D4-SW3 in October 2018 was 266 mg/L, the minimum recorded calcium concentration was 208 mg/L and the maximum was 329 mg/L. The mean calcium concentration at D4-SW5 between October 2018 and December 2018 was 169 mg/L, the minimum recorded calcium concentration was 48 mg/L and the maximum was 318 mg/L.

At D1-SW12, which is also downstream of the mine water discharge but within the River Glyde, the mean calcium concentration between October 2018 and October 2019 (which is since the change in water management change and includes summer low river flow conditions) was 66 mg/L. The minimum recorded calcium concentration was 7 mg/L and the maximum was 144 mg/L. These levels are all substantially below the limit for groundwater of 200 mg/L stated in EPA (2003).

Downstream of the mine water discharge in the River Glyde at D1-SW16, the mean calcium concentration between October 2018 and October 2019 was 77 mg/L and ranged from 7 mg/L to 135 mg/L (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 3). These levels are also substantially below the limit for groundwater of 200 mg/L stated in EPA (2003).

Conductivity

Conductivity levels exceeded the compliance limit of 1,000 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 in the River Bursk between October 2018 and October 2019 but did not exceed this limit at D1-SW16 in the River Glyde (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 4).

The mean conductivity level between October 2018 and October 2019 (which is since the change in water management and includes summer low river flows) at Compliance Point CP-1 was 808.5 $\mu\text{S}/\text{cm}$ and ranged from 100 $\mu\text{S}/\text{cm}$ to 1,897 $\mu\text{S}/\text{cm}$. The mean conductivity level at D1-SW16 during this period was 492.5 $\mu\text{S}/\text{cm}$ and ranged from 258 $\mu\text{S}/\text{cm}$ to 744 $\mu\text{S}/\text{cm}$ (SGCPIL, 2020; Volume 3, Appendix A.6.3, Graph 4). The levels at D1-SW16 are well below the limit of 1,000 $\mu\text{S}/\text{cm}$ (EPA, 2003).

6.3.6 Future Baseline

Normally a statement setting out the expected future baseline situation is given. However, as stated above the mine water discharge under assessment is already discharging at a rate and quality that is expected to continue similarly into the future, assuming no actions are taken to ameliorate it. Therefore, it is appropriate to assess the current baseline information stated above.

6.4 Assessment of Potential Impacts

6.4.1 Baseline Features Screened Out of Impact Assessment

Plant species are not considered further in this assessment. This is because a) no records of protected or otherwise positively notable species were returned in the desk study within 5 km of the discharge point or factory site, apart from one moss species which is not associated with water, b) although smooth brome occurs within 5 km of the discharge point, it is unlikely to occur along the non-wooded downstream river banks since it is chiefly a species of unimproved grassland and adjacent land is heavily agricultural, c) non-aquatic invasive non-native plant species are unlikely to be significantly affected because they do not grow in water and there is no mechanism for the Proposed Licence Amendment to spread them, and d) whilst invasive non-native Canadian waterweed is recorded in the area, the Proposed Licence Amendment poses no risk of spreading it and could perhaps reduce it if present in the nearer downstream watercourse.

6.4.2 Importance of Ecological Features

Relevant ecological features are those that are considered to be 'important' and have the potential to be affected by the Proposed Licence Amendment (CIEEM, 2018; Table 6-3). The potential effect of the Proposed Licence Amendment on ecological features that require impact assessment are considered to be changes to water quality downstream of the mine discharge point, which could deteriorate designated sites and lead to the loss of protected and / or notable habitats and species. The potential effect is related to the operational phase as the mine water is already being discharged under the rates being reviewed.

Table 6-3 Importance of Ecological Features

Ecological Feature	Importance	Rationale
Stabannan-Braganstown SPA	International (Very high)	International nature conservation designation.
Dundalk Bay SPA and Ramsar site	International (Very high)	International nature conservation designation.
Dundalk Bay SAC	International (Very high)	International nature conservation designation.
Ballyhoe Lough pNHA	National (High)	National nature conservation designation.
Stabannan-Braganstown pNHA	National (High)	National nature conservation designation.
Dundalk Bay pNHA	National (High)	National nature conservation designation.
Breakey Loughs pNHA Corstown Loughs pNHA Monalty Lough pNHA Lough Naglack pNHA Lough Fea Demesne pNHA	National (High)	National nature conservation designation. These sites are being considered together because they all have the same connectivity and potential impact.
Non-designated freshwater habitat – River Glyde	National (High)	The River Glyde is a substantial river of significant length. It passes through or along the boundary of three counties (Monaghan, Meath and Louth) and is therefore considered in its entirety to be of national importance.
Non-designated freshwater habitat – River Bursk, Bursk Lough and Rahan Lough	County (Medium)	The River Bursk is a small river, approximately 15 km long, excluding small tributaries. This resource as a whole is clearly more than locally important, but is not considered nationally important, therefore County importance is considered appropriate. The downstream loughs on the River Bursk include Rahans Lough which has been previously considered as a candidate NHA, and although it has evidently not been accepted as a pNHA / NHA (which would result in national importance), the size of this lough and presence of notable habitats including mesotrophic open water, sedge / reed swamps and wet woodland also indicates county importance.

Ecological Feature	Importance	Rationale
Fish population	County (Medium)	Watercourses and loughs downstream of the mine site support several fish species. This includes salmonid species, brook lamprey and European eel. The latter is critically endangered, and the Monaghan County Development Plan 2019-2025 sets out to protect Salmonid Waters, which suggests county importance. Moreover, the population of such notable fish in the downstream River Bursk or (in a likely worst-case scenario) an overall small part of the River Glyde would not be of national consequence.
Aquatic macroinvertebrate population	County (Medium)	There are not known to be any notable macroinvertebrates in the downstream River Bursk and nearer River Glyde according to current knowledge, however the populations in these stretches of potentially affected watercourses is clearly of more than Site importance by virtue of the length of watercourse involved. However, such invertebrates support fish and thereby higher predators including protected species considered to be of county importance, therefore macroinvertebrate populations as a whole in the downstream several kilometres of watercourses are considered also of county importance.
Otter population	Medium (County)	Otter is a European Protected Species. The range of otters is large therefore the population using the area is considered to be of more than local importance, but they are widespread in Ireland which precludes assignment of national importance.
Kingfisher population	Medium (County)	Effects on downstream watercourses could extend several kilometres and may therefore occur within the range of several pairs of kingfisher. Should several pairs of kingfisher be adversely affected, this would be of more than local importance, but not of national importance.
Bat populations	Local (Local higher)	All bat species are protected under the Habitats Directive, but the species known to be present in the area are not rare at the county or national level. The downstream watercourses / waterbodies provide connectivity and foraging habitat for bats within an otherwise predominantly heavily agricultural landscape.
Amphibian populations	Local (Local higher)	Common frog and smooth newt <i>Lissotriton vulgaris</i> are protected under the Wildlife Acts. However, they are not rare at the county or national level. The downstream waterbodies provide important connectivity, foraging and breeding habitat for amphibians within an otherwise predominantly heavily agricultural landscape.

6.4.3 Ecological Effects of Water Quality

In order to understand the effects of the mine water discharge on ecological features, it is necessary to understand the current and potential levels of relevant water quality parameters in the River Bursk and River Glyde, and their possible ecological effects. This information is set out below prior to the assessment of impacts on ecological features. The primary parameter under consideration is sulphate, but since the discharge releases this as calcium sulphate, information is also provided for calcium and (since both directly affect it) conductivity.

The information below refers to effects on macroinvertebrates, fish and plants, which occur in or adjacent to the affected waterbodies. In addition to the intrinsic ecological value of these groups, they can also constitute foraging resources for other ecological features relevant to this assessment, including otter, kingfisher and some bird species for which nature conservation sites are designated.

6.4.3.1 Sulphate Limits and EQS

The limit for groundwater sulphate (SO_4) levels in EPA (2003) is 200 mg/L.

There are only a very small number of published Environmental Quality Standards (EQS) pertaining to sulphate. In the USA, for the states of Illinois and Iowa only, the sulphate limit (measured as a 30-day average) is at minimum 500 mg/L, and higher for moderate or high water hardness (Illinois Environmental Protection Agency Bureau of Water, 2008; Iowa Department of Natural Resources, 2009).

The British Columbia (BC) *Ambient Water Quality Guidelines for Sulphate* (BC, 2013) were specifically referenced by IFI in their response to the licence review (IFI, 2019). It reviews the literature on sulphate impacts on aquatic life and provides variable sulphate concentration limits depending on background water hardness. In the River Bursk,

the water hardness upstream of the discharge at D4-SW1 is 133.9 mg/L on average, which BC (2013) considers being a 'moderate soft / hard to hard' water hardness. Based on this water hardness, BC (2013) recommends for the protection of aquatic life that sulphate concentration should not exceed 309 mg/L over a 30-day average (minimum of five evenly spaced samples collected in 30 days).

Finally, Stockholm University carried out an investigation into sulphate ecotoxicity studies, and after assessing the reliability of such studies proposed an EQS for sulphate in Sweden (Stockholm University, 2018). Unlike the above EQS, this investigation proposed annual average sulphate concentration and maximum allowable concentration, which, at the equivalent water hardness of the River Bursk / Glyde, were between 41.9 and 56 mg/L for annual average, and between 158 and 377 mg/L for maximum allowable concentration.

The Swedish study, whilst more recent, advises annual average sulphate concentrations that are extremely low and far below sulphate concentrations determined to be toxic to aquatic organisms in the reviewed toxicity studies (see below). On the other hand, the maximum allowable concentrations in the Swedish proposals, although not averages, are not dissimilar to the 30-day average concentrations advised in BC (2013). The BC (2013) guidance is based on a range of studies covering three trophic levels (plant, invertebrate and fish), employs averaging of multiple modelling techniques to account for modelling variability, and uses data from long-term studies. Long-term studies are considered most relevant in this case because the discharge will cause long-term (chronic) exposure. The sulphate limits in BC (2013) took account, on a precautionary basis, of the most sensitive species (the young stages of a salmonid fish). The few limits proposed in the USA are higher than BC (2013), to the extent that they appear contrary to some ecotoxicity studies (see below), and in view of the precautionary but reasonable nature of the BC (2013) study, the BC (2013) guidance is considered most appropriate for use in this assessment.

6.4.3.2 Sulphate Effects

The toxicity of sulphate to aquatic organisms is widely known to vary according to water hardness, such that toxicity tends to be reduced (with some variation according to the species) as water hardness increases (e.g. Davies 2006 and Elphick *et al* 2011), and water hardness should be taken into account in considering sulphate toxicity.

Sulphate Effects on Invertebrates

The published literature on the impacts of sulphate on aquatic life mainly focuses on freshwater invertebrates. There is great variability in the sensitivity of invertebrates to sulphates. The most sensitivity amongst the studies found was for *Neocleon triangulifer* (mayfly larvae), which for chronic exposure (36 days) exhibited no effect at 129 mg/L (i.e. there was an effect at higher concentrations).

Most studies appear to investigate acute toxicity (over the short-term, typically two days). Chronic toxicity (which is more applicable to a constant mine discharge), as might be expected given the longer term exposure, tends to occur at lower sulphate concentrations than acute toxicity studies. One study found that the mean lethal concentrations of sulphate to 50% mortality of a sample population (LC50s) in moderately hard water were 512 mg/L for *Hyalella azteca* (amphipod crustacean), 2,050 mg/L for *Ceriodaphnia dubia* (water flea), 2,078 mg/L for *Sphaerium simile* (finger nail clam), and 14,134 mg/L for *Chironomus tentans* (midge species) (Soucek and Kennedy, 2004).

Elphick *et al* (2011) found that at a water hardness of 80 to 100 mg/L, the LC50 value for *Hyalella azteca* was 2,099 mg/L sulphate. The 25th percentile inhibition concentration of sulphate (IC25) for *Brachionus calyciflorus* (rotifer) reproduction rates at a water hardness of 160 mg/L was 1,292 mg/L sulphate. The 50th percentile inhibition concentration of sulphate (IC50) for *Ceriodaphnia dubia* reproduction rates at a water hardness of 160 mg/L was 1,257 mg/L sulphate.

Soucek (2007) studied the impacts of sodium sulphate on *Corbicula fluminea* (Asian clam) through four-week exposures of 1,500 mg/L sulphate. The results indicated that there was no effect on basal metabolic rates of *Corbicula fluminea*, but there were significantly reduced feeding rates, post-feeding metabolic rates, and growth rates. The effects of sulphate on filter-feeding bivalves could cause changes in the whole stream respiration rates and organic matter dynamics, which may include altered uptake rates of other contaminants that can be antagonized by sulphate, such as selenium (Soucek, 2007; BC, 2013).

Another study found that following leaks of a gypsum pond in Finland, a nearby lake shifted from a mesotrophic state towards a more oligotrophic state between 2005 to 2014 with an elevated hardness and higher calcium concentrations. The benthic invertebrate community changed drastically in the deeper zones. Diatom and cladoceran community structure also altered with decreased species richness and diversity. The highest sulphate concentration was 1,200 mg/L in the mixolimnion of the lake, but the results suggested that salinity levels most

likely impacted the biological communities though decreasing oxygen and light levels at the lake bottom (Leppänen *et al*, 2017).

Timpano *et al* (2010) assessed mining impacts including elevated levels of total dissolved solids (TDS) on benthic macroinvertebrate communities via collecting a single benthic macroinvertebrate and water quality sample at 17 headwater stream sites of Virginia, USA during spring 2009 (n=17). They found that sulphate dominated the TDS and was a good candidate for single-parameter prediction of biological condition. There was a significant negative correlation between TDS / ions and family-level macro-invertebrate community richness, particularly for the sensitive insect orders of Ephemeroptera (mayflies), Plectoptera (stoneflies), and Trichoptera (caddisflies) (together known as EPT Taxa in this study). Based on their scatter plot matrix, the number of EPT Taxa appears to steadily decline between acute values of 200 and 531 mg/L sulphate (Timpano *et al*, 2010).

Sulphate Effects on Fish and Amphibians

There are relatively few studies of the effects of sulphate on fish.

The early stages of rainbow trout *Oncorhynchus mykiss* (the 21-day embryo to alevin life stage) are particularly sensitive to sulphate in water of low hardness, but the sulphate toxicity ameliorates with increasing water hardness. The sulphate toxicity level at a water hardness of 100 mg/L for LC10 (10% mortality rate) was 444 mg/L sulphate, whilst for LC20 and LC50 at 100 mg/L water hardness it was 618 and 1,093 mg/L sulphate, respectively (BC, 2013, quoting research by Kennedy, C., at Simon Fraser University). Rainbow trout are closely related to Atlantic salmon and brown trout, which are present in the Glyde catchment, and it is reasonable in the absence of other evidence and on a precautionary basis to assume that they are similarly sensitive to sulphate.

Mount *et al* (1997) reported a LC50 (50% mortality rate) concentration of sulphate for the adult fathead minnow *Pimephales promelas* to be 7,960 mg/L. Elphick *et al* (2011) found that in a water hardness of 160 mg/L, the EC50 concentration of sulphate (50th percentile effect concentration) for the survival of adult fathead minnow was 4,553 mg/L sulphate. The EC25 concentration of sulphate (25th percentile effect concentration) in low water hardness of 15 mg/L for embryo development in rainbow trout and coho salmon *Oncorhynchus kisutch* was 501 mg/L and 1,264 mg/L sulphate, respectively (Elphick *et al*, 2011).

Wang *et al* (2016) found that fathead minnow was highly sensitive during the younger stages (embryo development to hatching) at a water hardness of 100 mg/L, with LC10 (10% lethality) occurring at 430 mg/L sulphate during chronic exposure (34 days). This contrasts with the above-quoted studies where 50% of adult fathead minnow survived sulphate exposures of over 4,500 mg/L. Although the latter were relatively short-term (seven days in the case of the Elphick *et al* (2011) study), the combination of this information does suggest that adult fish are much more resistant than eggs and recently-hatched fish. At least in part, this is probably a result of the inherently more delicate and sensitive structure of eggs and recently-hatched fish, and their greater surface area in proportion to volume. Another study by Chapman *et al* (2000) used reconstituted mine effluent similar to that being assessed in this EIA, and this found that there was no effect (with four-day exposure) on rainbow trout eggs or recently-hatched fish at 1,450 mg/L sulphate.

Elphick *et al* (2011) also assessed the effects of sulphate on a frog species. The results indicated that the EC25 concentration of sulphate for the survival of Pacific tree frog *Pseudacris regilla* was 1,205 mg/L.

Sulphate Effects on Plants and Micro-organisms

In one study, toxicity to aquatic moss ranged from 100 to 250 mg/L sulphate and there was a reduction in mean chlorophyll levels at 400 mg/L sulphate in soft water (Frahm, 1975; BC, 2013). Davies (2006) demonstrated that the shoots of *Fontinalis antipyretica* (an aquatic moss) displayed a significant reduction at 1,500 mg/L sulphate and that chlorophyll levels significantly reduced at 1,000 mg/L sulphate at a medium water hardness of 105 mg/L, which challenged previous findings from Frahm (1975) stated above that the toxic threshold of sulphate to *Fontinalis antipyretica* was 100 mg/L sulphate. Elphick *et al* (2011) found that the EC25 concentration of sulphate (25th percentile effect concentration) affecting growth of *Fontinalis antipyretica* in a water hardness of 15 mg/L was 828 mg/L sulphate.

Elphick *et al* (2011) demonstrated that the EC10 concentration of sulphate (10th percentile effect concentration) affecting cell yield of *Pseudokirchneriella subcapitata* (a green algae) in a water hardness of 80 mg/L was 1,345 mg/L sulphate.

Micro-organisms such as bacteria, protozoa, and ciliates have no apparent toxicity of sulphate up to 8,000 mg/L (BC, 2013). However, bacteria sulphate reductions produce sulphide, which can interfere with iron-phosphate binding in sediments and is phototoxic to many aquatic plants (Jørgensen, 1982; BC, 2013). A study on *Zizania*

palustris (wild rice cultivations) found that sulphide significantly reduced juvenile seedling growth and development at concentrations greater than 320 µg/L in hydroponic solutions (Paster *et al*, 2016). In outdoor freshwater mesocosms, sulphate additions increased the sulphide production and the *Zizania palustris* populations became extinct during a 5-year period with 250 mg/L of sulphate in the overlying water (Paster *et al*, 2016).

There are also other indirect effects of sulphate including the increase of phosphorus availability, susceptibility to eutrophication and mercury mobilization (BC, 2013). In a study on anoxic rice paddy soil contaminated with mercury, which is a known toxin, mercury dissolved with sulphate additions to the soil (Wang *et al*, 2015). Eutrophication and SO₄ pollution can be toxic at the species and community level of wetlands leading to the dominance of highly competitive plant species (Geurts *et al*, 2009; Lamers *et al*, 1998).

6.4.3.3 Calcium Limits and Effects

The limit for groundwater calcium (Ca) levels in EPA (2003) is 200 mg/L. Calcium is an essential element for living organisms and <1.5 mg/L Ca concentrations are considered to be a critical threshold for the survival of many organisms (Weyhenmeyer *et al*, 2019). The global median calcium concentration in inland freshwater habitats is 4.0 mg/L (Weyhenmeyer *et al*, 2019). The maximum calcium concentration at monitoring point D1-SW16 in the River Glyde, which is approximately 16 km downstream of the mine water discharge point, was 135 mg/L Ca between October 2018 and October 2019 (SGCPIL, 2020).

Weyhenmeyer *et al* (2019) demonstrated that freshwater ecosystems affected by anthropogenic acid deposition had disproportionately high calcium concentrations relative to alkalinity (the normal ratio between calcium and carbonate alkalinity is 1:1), which were accompanied by high sulphate concentrations.

Calcium Effects on Invertebrates

Most of the literature investigates the effects of limited calcium on invertebrates (Ormerod *et al*, 1998; Keller *et al*, 2001; Jeziorski and Smol, 2016) and there are very few studies assessing the excess of calcium. Other studies investigate the effects of calcium bound to another molecule such as lime (Ca(OH)₂) (Miskimmin *et al*, 1995) or calcium carbonate (CaCO₃) (Corrêa *et al*, 2018). Lime used as a treatment for eutrophic waters has been shown to extirpate invertebrate communities immediately after treatment, but this invertebrate diversity and biomass recovered after three years (Miskimmin *et al*, 1995). Calcium carbonate precipitation has been suggested to reduce invertebrate diversity in some tropical streams, but also can provide microhabitats and support high biodiversity for insect larvae and other organisms in some karst streams (Corrêa *et al*, 2018).

Glover and Wood (2004) found that calcium-dependent sodium uptake in *Daphnia magna* (water flea) was inhibited at 1 mmol/L calcium at pH 4, which can lead to mortality in the *Daphnia magna*.

The magnesium / calcium (Mg / Ca) ratio can ameliorate the toxicity of heavy metals due to the competitive exclusion of heavy metals by Mg²⁺ and Ca²⁺ and can influence the structure of macroinvertebrate communities (Bere *et al*, 2016).

Scheuhammer *et al* (1997) measured the concentrations of calcium in aquatic invertebrates consumed by insectivorous waterfowl and found that calcium concentrations were highest in molluscs. pH influenced the presence of molluscs and they were absent from lakes below a pH of 5.3. Reduced availability of calcium with lower diversity of prey in acid-stressed environments was more likely to affect waterfowl reproduction success than an increased exposure to toxic metals (Scheuhammer *et al*, 1997).

Calcium Effects on Fish

The majority of studies on calcium impacts to fish also investigated the limitations of low calcium concentrations, not the effects of high concentrations (Keller *et al*, 2001; Rodgers, 1984; Brown, 1982). For example, Rodgers (1984) assessed growth of juvenile brook trout *Salvelinus fontinalis* in water with 5.3 or 6.5 pH and calcium concentrations of 5 or 40 mg/L and demonstrated that there were significantly reduced growth rates of brook trout in low calcium concentrations and low pH levels. Stekoll *et al* (2009) found that calcium contributed to decreased fertilization rates in salmonids with an EC50 of 102 mg/L Ca²⁺ and EC20 of 25 mg/L Ca²⁺ in coho salmon.

However, Ketola *et al* (1998) found that Atlantic salmon and trout eggs hardened in water with high Ca²⁺ concentrations (>520 mg/L). The survival rates of Atlantic salmon, brook trout and rainbow trout were significantly reduced in high calcium concentrations (Ketola *et al*, 1998; BC, 2013).

Luo *et al* (2016) demonstrated that Ca²⁺:Mg²⁺ ratios less than 1:20 or greater than 8:1 had negative impacts on the hatching, feeding, development, larval growth and survival of early life stages of *Gobiocypris rarus* (rare minnow).

Calcium Effects on Plants and Micro-organisms

Similarly to the literature on calcium effects on invertebrates and fish, most research on plants focusses on the importance of calcium as an essential macro-nutrient and the negative impacts of calcium deficiencies (Thor, 2019). However, when there is excessive calcium in the rhizosphere, plants can suffer from calcium toxicity, which may prevent germination of seeds and reduce growth rates (White and Broadley, 2003). Gorham and Bridges (1995) demonstrated that the optimum concentration of calcium for *Gossypium hirsutum* (cotton) growth was between 40 mg/L to 601 mg/L Ca^{2+} in a hydroponic culture with 100-150 mol/m³ sodium chloride.

6.4.3.4 Conductivity Limits and Effects

Electrical current in water is conducted by dissolved salts and other inorganic chemicals. The limit for groundwater electrical conductivity in EPA (2003) is 1,000 $\mu\text{S}/\text{cm}$. electrical conductivity at monitoring point D1-SW16 in the River Glyde (16 km downstream of the mine water discharge point) did not exceed the regulation limit of 1,000 $\mu\text{S}/\text{cm}$ between October 2018 and October 2019, with a maximum conductivity of 744 $\mu\text{S}/\text{cm}$ (SGCPIL, 2020).

Jong et al (2011) investigated the thresholds for conductivity and the US Environmental Protection Agency upper limit benchmark of 300 $\mu\text{S}/\text{cm}$ for central Appalachian streams dominated by sulphates. However, Jong et al (2011) considers that the use of conductivity or total dissolved solids as a criterion to assess freshwater ecosystem health may be ineffective because toxicity can vary with species type and varying ion composition and water hardness. Additionally, it should be noted that the Rivers Bursk and Glyde are not low-conductivity watercourse, having moderate baseline conductivity levels upstream of the mine site.

The conductivity and salinity of estuaries are variable as they are influenced by both freshwater and saltwater flows. Therefore, organisms in brackish water have adapted to these fluctuations in salinity levels (Cloern et al, 2017).

Conductivity Effects on Invertebrates

Clements and Kotalik (2016) assessed the US Environmental Protection Agency aquatic life upper limit benchmark for conductivity of 300 $\mu\text{S}/\text{cm}$ on freshwater benthic communities in naturally low-conductivity streams and found that this benchmark is protective of freshwater aquatic insect communities. It should be noted, however, that the Rivers Bursk and Glyde are not low-conductivity watercourses, having moderate baseline conductivity levels upstream of the mine site.

Ephemeroptera (mayflies) in freshwater were particularly sensitive to an increase in major ion content with their abundance often decreasing at conductance near or less than 300 $\mu\text{S}/\text{cm}$ (Clements and Kotalik, 2016). Goetsch and Palmer (1997) found that mortality in a *Tricorythus* species (Ephemeropteran mayfly) was not only influenced by conductivity or TDS, but also the type of salt present. sodium sulphate was toxic to *Tricorythus* species with a 96-hour LC50 of 660 mg/L (Goetsch and Palmer, 1997; BC, 2013).

However, toxicity testing of *Ceriodaphnia dubia* demonstrated that there was no relationship between conductance and the survival of *Ceriodaphnia dubia* in streams influenced by mine water (Armstead et al, 2016).

Shackleton et al (2019) studied the freshwater macroinvertebrate responses to conductivity in five regions of Australia based on nineteen years of macro-invertebrate field data. Hazardous concentration 5th percentiles (HC05) of electrical conductivity for each bioregion based on species density distributions using 95% extirpation concentration values for genera ranged from 29 $\mu\text{S}/\text{cm}$ to 2,226 $\mu\text{S}/\text{cm}$. These results indicate that a region-specific determination of electric conductivity effects may be needed (Shackleton et al, 2019).

Conductivity Effects on Fish

Chinook salmon *Oncorhynchus tshawytsch*, pink salmon *Oncorhynchus gorbuscha*, and coho salmon were most sensitive, and Arctic charr *Salvelinus alpinus* were least sensitive to elevated salts in a study by Stekoll et al (2009). Based on these results Stekoll et al (2009) suggested that the Alaska water quality standards of 1,000 mg/L for TDS should not be increased and that it may be too high for some fish species since the fertilization success of salmonids was reduced at TDS levels of 250 mg/L.

Atlantic salmon eggs in freshwater were suppressed by salinities below 1 part per thousand (ppt) and salinities between 2.7 and 3.1 ppt (Li et al, 2009). However, rainbow trout and chinook salmon eggs in freshwater were not affected at salinities of 0, 4, 8, and 12 ppt (Morgan et al, 1992). Sørensen et al (2015) also did not find any relationship between salinity and European eel egg dimensions, but they demonstrated a positive relationship between egg neutral buoyancy and activation salinity.

Rowe and Dunson (1995) demonstrated that there were no significant effects of salinity on the growth or survival of juvenile sheepshead minnow *Cyprinodon variegatus* or silversides *Menidia beryllina* in a study on outdoor saltmarsh mesocosms. However, 8 ppt salinity was considered to be the upper limit for normal development of rainbow trout and chinook salmon based on the metabolic rate and survival of the newly hatched alevins (Morgan *et al*, 1992).

Conductivity Effects on Plants and Micro-organisms

Many studies on the effects of conductivity on plants assess the negative impacts of high salinity on crop plants which can include reduced growth rates and crop yields (Shrivastava and Kumar, 2015). Ding *et al* (2018), for example, demonstrated that pakchoi *Brassica rapa* subsp. *chinensis* growth rates were optimized at moderate electrical conductivities between 1,800 $\mu\text{S}/\text{cm}$ and 2,400 $\mu\text{S}/\text{cm}$.

Hart *et al* (1990) considers that adverse biological effects to riparian vegetation, macrophytes and micro-algae in sensitive freshwater ecosystems are likely to occur at salinity levels of 1,000 mg/L based on research in Australia.

Cañedo-Argüelles *et al* (2019) reviewed the impacts of salinisation in freshwater ecosystems and found that salinisation can alter overall ecosystem function through various effects, including changes in organic matter processing, changes in the export of detritus from vegetation into streams, and changes to microbial decomposer and detritivore growth.

Relevance of the Water Quality Parameters to Assessment

Baseline calcium levels (see Graph 3 in Volume 3, Appendix A.6.3), as indicated by monitoring at D4 SW1, are low. The discharge can only elevate the calcium level. However, recorded levels in the October 2018 to October 2019 monitoring period did not approach the concentrations at which adverse effects might occur. Even accounting for increased concentration during occasional lower rainfall than experienced in that monitoring period, it appears unlikely that calcium concentration could be a significant adverse factor for ecological features, certainly in comparison to sulphate.

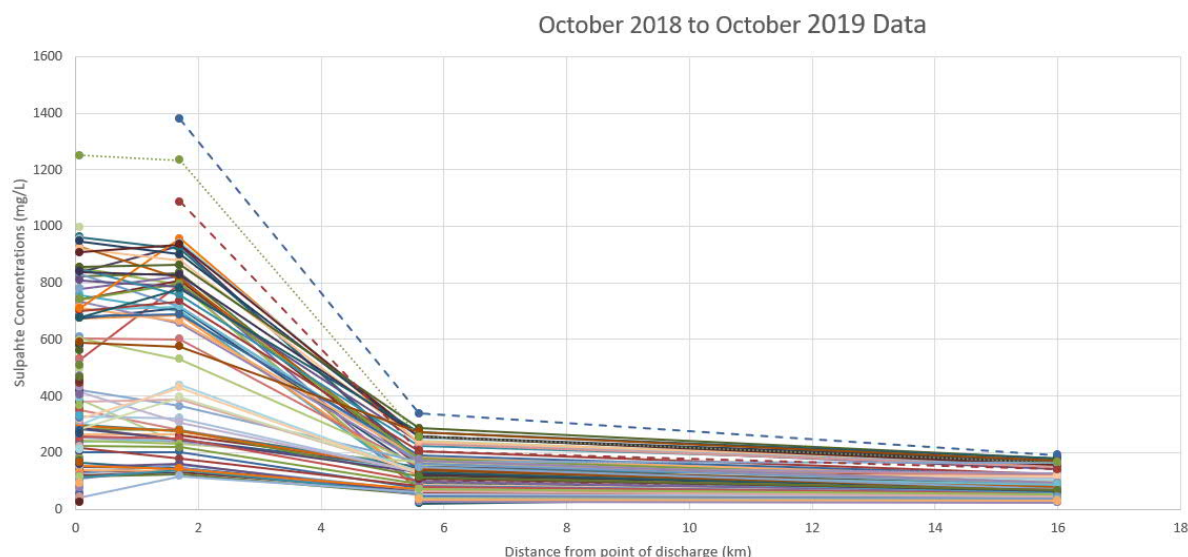
Whilst conductivity was occasionally higher than the recommended limit for groundwater of 1,000 $\mu\text{S}/\text{cm}$ (EPA 2003, which tends to be supported by the above-mentioned conductivity studies) at Compliance Point CP-1 (see Graph 4 in Volume 3, Appendix A.6.3), it was below this limit for the majority of the time in the October 2018 to October 2019 monitoring period, such that the mean conductivity (808.5 $\mu\text{S}/\text{cm}$) is significantly below this limit at CP1.

In contrast, sulphate concentration was often higher than the 309 mg/L mean monthly limit advised in British Columbia 2013 (BC 2013), with a mean (340 mg/L) significantly above this limit at CP1. Conductivity is closely connected to the sulphate concentration, such that lowering sulphate concentration causes lower conductivity, and raising it increases conductivity; indeed, some conductivity studies use total dissolved solids (TDS) as a measure, of which the principal component in the mine water discharge is sulphate. Thus, the regulation of sulphate concentration indirectly regulates the associated conductivity.

In view of the above, sulphate is considered the most relevant of these water quality parameters, and the following assessment primarily considers sulphate concentrations in light of its associated indirect proportional effect on conductivity.

6.4.4 Predicted Sulphate Levels, Rainfall, and River Bursk Flow Analysis

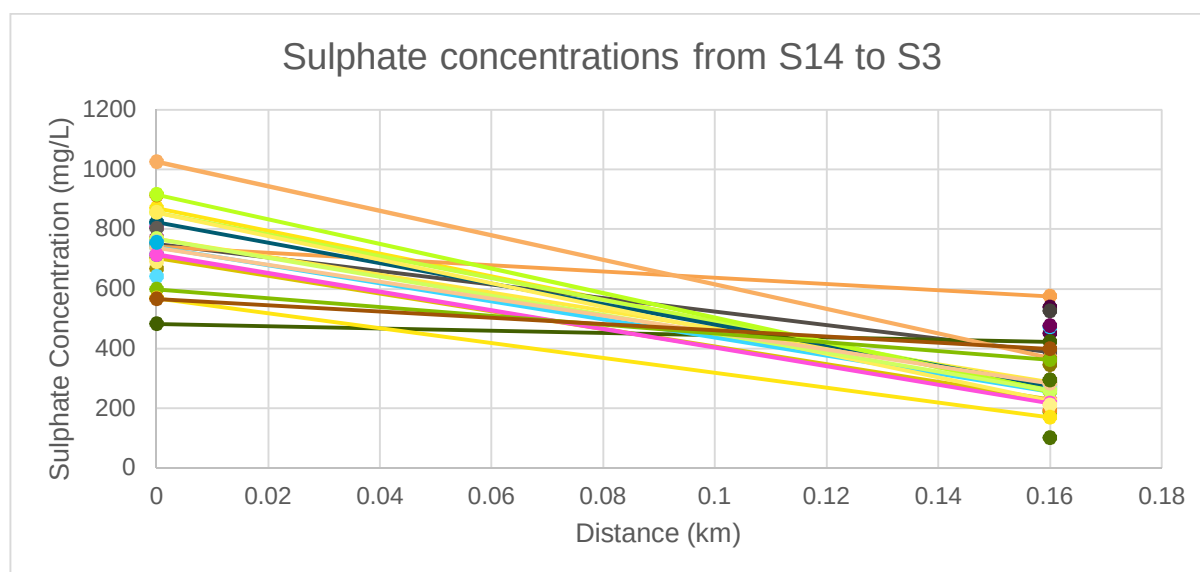
The graph below shows recorded sulphate levels at the various monitoring points downstream of the mine water discharge point in the period October 2018 to October 2019 (Volume 3 Appendix A.6.2 Figure A6-2 shows these monitoring point locations), which is just after the change of water management at the mine in September 2018. The graph also show predicted sulphate levels at the maximum requested licence level of 1,250 mg/L, calculated using a regression analysis between sulphate concentrations at each monitoring point between October 2018 and October 2019 to extrapolate the data (Graph 6-1).



Graph 6-1 Prediction of sulphate concentrations downstream of the mine water discharge point based on sulphate concentration data at monitoring points CP-1, D4-SW5, D1-SW12, and D1-SW16 from October 2018 to October 2019 where available. Data points within solid lines indicate actual sulphate concentrations recorded at the monitoring points. Data points within green dashed lines indicate hypothetical sulphate concentrations based on 1,250 mg/L at CP-1. Blue dashed lines indicate upper 95% prediction intervals and red dashed lines indicate lower 95% prediction intervals based on 1,250 mg/L at CP-1.

This graph suggests that in the worst case of the maximum requested licence level of 1,250 mg/L at Compliance Point CP-1, sulphate levels on a daily basis could likely be 1,234 mg/L with a 95% prediction interval (PI) upper limit (UL) of 1,380 mg/L and lower limit (LL) of 1,088 mg/L at D4-SW5. At D1-SW12, sulphate could likely be 257 mg/L with 95% PI UL of 352 mg/L and LL of 162 mg/L. At D1-SW16, sulphate could likely be 165 mg/L with 95% PI UL of 191 mg/L and LL of 140 mg/L.

Graph 6.2 below shows sulphate information for the factory site in similar fashion, using data from the factory site discharge point (S14) and the monitoring point S3 shortly downstream of the factory site discharge point, over the time period January 2017 to July 2020 (Volume 3 Appendix A.6.2 Figure A6-3 shows these monitoring point locations).



Graph 6-2 Sulphate concentrations downstream of the factory site discharge point, based on sulphate concentration data at factory site monitoring points S14 and S3, from January 2017 to July 2020.

Graph 6.2 shows that in the three and half years covered by this data, the factory site discharge fairly uniformly fell to below 700 mg/L within 200 m of the factory site discharge point. This is a much more rapid fall off in concentration than shown in Graph 6.1 above for the mine site, in which there is not a significant drop in concentration until the confluence of the River Bursk with the River Glyde.

It should be noted, however, that Graph 6.1 effectively includes the mine site and factory site discharges for monitoring points D1-SW12 and D1-SW16. This is because these monitoring points are downstream of the confluence of the River Bursk and River Glyde (the mine site discharges to the River Bursk, and the factory site to a tributary of the River Glyde well upstream of the confluence). In this way, the discussions below take account of both the factory site discharge and the discharge from the mine site to which the Proposed Licence Amendment applies.

It is important to note that sulphate levels do not in general change significantly between Compliance Point CP-1 and D4-SW5, indicating that no appreciable dilution is taking place. Additionally, whilst the large drop in sulphate levels between D4-SW5 and D1-SW12 is shown as straight lines this is only because there are no intervening monitoring points, it is reasonable to assume, owing to a lack of significant intervening tributaries (see Volume 3, Appendix A.6.2, Figure A4-2), that the primary dilution factor is the River Glyde, a far more substantial watercourse than the River Bursk. It is therefore taken that water quality for the 2.3 km of the River Bursk between the discharge point and the confluence with the River Glyde will be similar to conditions at Compliance Point CP-1. This certainly includes Bursk Lough, because this is located upstream of D4-SW5. It is also taken to include Rahans Lough, both on a precautionary basis in the lack of data for Rahans Lough and because there is no significant water flow into Rahans Lough other than the River Bursk (see Volume 3, Appendix A.6.2, Figure A4-2).

It is also important to note that the upper prediction intervals in the above graphs account for large variation in sulphate concentrations because it is possible that sulphate concentrations may reach considerably high levels on a certain day (e.g. periods with low rainfall, low River Bursk flows, and high mine water discharge).

However, a more important measurement for nature conservation purposes than peak concentration at any one time is the degree of prolonged (chronic) exposure; hence BS (2013) recommends an average taken over 30 days, with at least five evenly-spaced measurements. The upper prediction levels in the above graphs do not mean that sulphate concentration would likely reach these upper limits for the average of an entire month. Therefore, further investigation into likely monthly mean sulphate concentrations was carried out.

The level of rainfall directly affects water flow in watercourses (albeit with a degree of delay), and lower water flows result in higher concentrations of discharged substances. Consequently, rainfall can be expected to have a strong effect on discharge concentration. Since available data (at the time of producing this assessment) from relevant water quality monitoring points after the change of mine water management covers only the period October 2018 to October 2019 (less for monitoring points D4-SW3 and D4-SW5, but extending to January 2020 for Compliance Point CP-1), and that rainfall is liable to vary more than within this limited monitoring period, it is relevant to investigate historical rainfall levels as guide to future rainfall levels and river flows.

Table 6-4 below shows monthly rainfall in millimetres for the last twenty years, obtained from Met Eireann for Carrickmacross, which is located relatively near the discharge point. It was considered reasonable to use data in this range and not older, owing to the possible effects of climate change. In this table, values in red highlight months in which rainfall was less than that recorded in the period October 2018 to October 2019.

Table 6-4 Monthly Rainfall (mm) Between 2000 to 2019 Obtained from Met Eireann for Carrickmacross

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	41.4	76.8	22.9	97.2	59.6	35.6	36.3	91.3	95.7	113.2	136.5	137.1	943.6
2001	45.2	58.7	100.5	57.2	55.8	48.6	30.2	98.1	36.3	90.6	35.3	30.6	687.1
2002	115.8	173.6	57.8	99.8	138.8	121.5	90.2	40.2	19.8	193.2	157	105.5	1313.2
2003	65.4	52.7	47.8	65.1	110.7	81.3	87.5	13.1	59.9	39.1	74.3	62.6	759.5
2004	90.3	36.7	62.6	49.1	43.9	81.1	50.5	117.1	65.4	125.1	39.8	63.1	824.7
2005	91.2	34.2	66.9	55.9	84.1	23.1	46.5	40	76.9	106.3	81.4	83.1	789.6
2006	30.5	31.3	149.1	45.1	110	20	54.6	67.3	154.1	125.4	102.5	107.4	997.3
2007	83.2	72.2	63.4	15.3	49.4	115.3	134.7	97.1	16.1	23.2	67.6	111.3	848.8
2008	144.6	36.3	87.7	31.9	33.3	54.4	89.1	164.8	82.1	98.6	53.6	49.4	925.8

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2009	88.6	18.7	32.1	88.1	88.4	63.3	171.6	112.5	26.5	93.6	160.4	61	1004.8
2010	59.7	40.5	66.3	42	42.7	51.6	147.7	36.6	148.9	45.6	84.8	53.6	820
2011	42.3	117.9	34	22.1	56.5	79.8	56	69.4	99.5	157.3	100.2	73.5	908.5
2012	84.3	35.7	10.7	52.3	46.7	199.9	94.2	108.1	58.3	83.3	75.9	122.1	971.5
2013	127.1	71.9	82	60.5	69.1	59	101.6	30.4	43.7	207.1	39.6	nd	892
2014	139	116.8	62.2	61.1	64.4	68.5	21.7	130.8	3.7	122.4	167.3	67.6	1025.5
2015	85.7	51.5	70.6	59.7	119.7	34.5	94.1	88.4	40.5	54.7	140	217.4	1056.8
2016	113.6	82.4	42.6	67.8	55.7	nd	70.9	64.3	74	46.4	nd	59.8	677.5
2017	23.7	66.3	81.3	12.4	52.1	83.2	82.2	68.5	123.7	96.2	58.3	72.4	820.3
2018	136.8	59.4	76.7	50.2	35.5	14.6	49.7	72.5	37.6	29.3	118.4	86.9	767.6
2019	26.6	51.7	137.6	80.6	35.8	116.1	59.2	133.2	103.3	88.9	nd	nd	833
Total	1748.2	1336.9	1409.3	1208	1408.5	1391.5	1600.3	1730.4	1523.5	1985.7	1765.8	1704.5	18812.6

nd = no data in downloaded dataset

This rainfall data shows that the percentage of months with less rainfall than that experienced in the period October 2018 to October 2019 was 5.8% for the last ten years, and 6.7% for the last twenty years. It is therefore considered reasonable to expect that in at least the near future approximately 0.72 (6%) of future months will experience less rainfall and consequently lower water flows and resultant higher discharge concentrations than recorded in the period October 2018 to October 2019. The lowest recorded monthly rainfall level in the last twenty years was 3.7 mm in September 2014.

Table 6-5 below shows mean sulphate level at the various water monitoring points for October 2018 to October 2019 (plus September 2018 when the change of water management occurred), together with mean discharge flow rate and mean River Bursk flow rate (at Compliance Point CP-1) for each month. In this table, values in red indicate mean sulphate levels above 309 mg/L, particularly high discharge flow rates, and particularly low River Bursk flow rates.

Table 6-5 The 30-day Mean Sulphate Levels (mg/L) per Month Between September 2018 and October 2019 (Post Mine Water Discharge Management Change) at Each Monitoring Point.

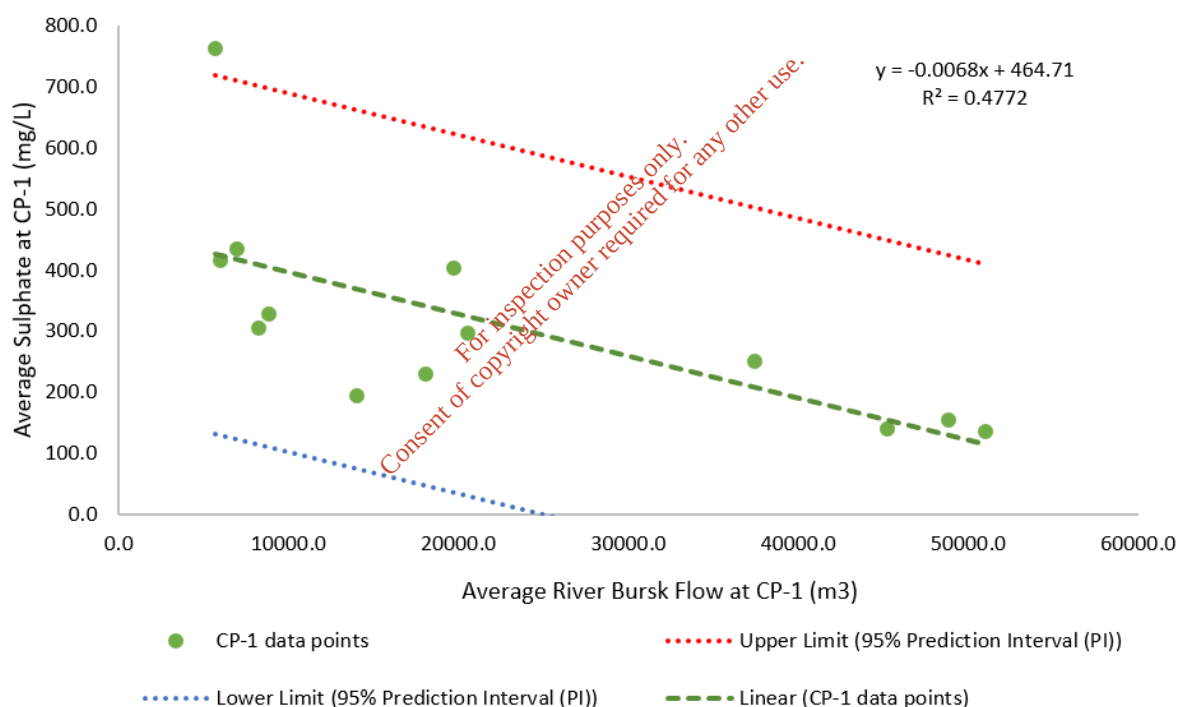
30-day Mean Sulphate Level														
	(S)	O	N	D	J	F	M	A	M	J	J	A	S	O
CP-1	25	762	404	140	329	229	154	305	417	194	435	250	297	135
D4 SW3	228	787												
D4 SW5	117	770	418	151										
D1 SW12	21	177	168	64	116	97	61	107	132	89	113	72	83	35
D1 SW16	25	111	122	61	74	71	47	58	75	55	63	53	53	31
mean discharge flow rate (m3/day)	729	5817	6319	5928	4462	4801	5963	4465	4095	3407	3330	4739	3912	4435
mean river flow (Bursk) (m3)	2251	5679	19736	45240	8872	18080	48820	8238	5996	14018	6948	37466	20548	51007

Table 6-5 suggests that in general, higher recorded mean sulphate levels correspond to either higher discharge flow rates or lower River Bursk flow rates. The highest mean sulphate level (for this period) in October 2018 occurred at the same time as higher discharge flow rate and low River Bursk flow for both that month and the preceding month. A higher discharge rate in March 2019 with nevertheless a low mean sulphate level is explicable by the water flow in the River Bursk, which was the second highest in this month of the monitoring period.

In order to help predict monthly mean sulphate concentrations at various river flow rates within the River Bursk, regression analysis was carried out using monthly river flow rates for the period October 2018 to October 2019 against mean sulphate levels at Compliance Point CP-1 (and other monitoring points where data is available) during the same months.

Based on the lowest recorded monthly rainfall level in the last twenty years of 3.7 mm and the River Bursk flow data from January 2017 to December 2019, there is potential for the River Bursk flow to reach very limited flow rates to theoretically zero flow (although zero flow would not occur).

The monitoring data for Compliance Point CP-1 exceeds the recommended mean sulphate limit of 309 mg/L (BC, 2013) and Graph 6.3 shows the results of this regression. Based on the regression in Graph 6., the predicted average sulphate concentration at the lowest potential River Bursk flow (which would theoretically be zero flow) would be 464.7 mg/L. However, there are several large deviations from the regression line in the available data points, of up to approximately 350 mg/L higher than predicted. The 95% prediction interval upper limit at hypothetical zero river flow is 758.2 mg/L and the lower limit is 171.1 mg/L.

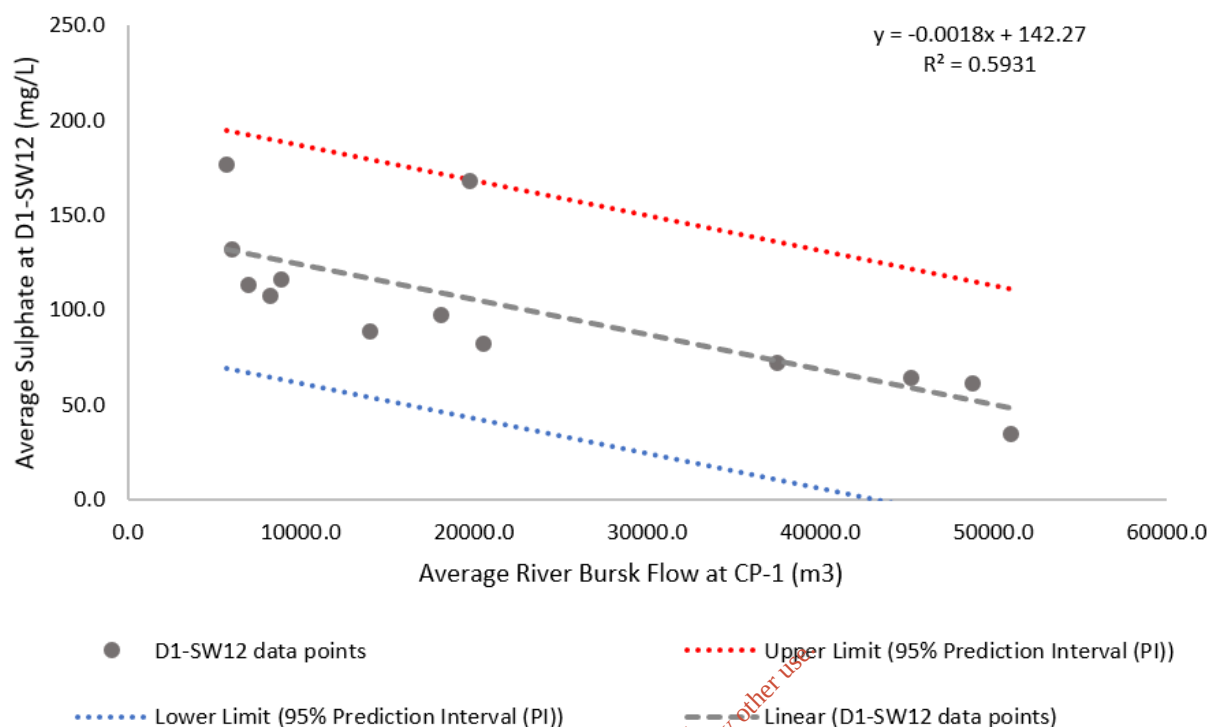


Graph 6.3 Average Sulphate at CP-1 per month vs average River Bursk flow at CP-1 per month between October 2018 and October 2019.

The correlation coefficient (R^2) for Graph 6.3 is 0.47. Whilst an R^2 value of 1 represents perfect correlation, and 0 no correlation, a value of 0.47 indicates that a substantial part of the variation in sulphate concentration is correlated with river flow. A very high correlation would be unexpected because the sulphate concentrations are also influenced by the degree of variation in mine water discharge rate.

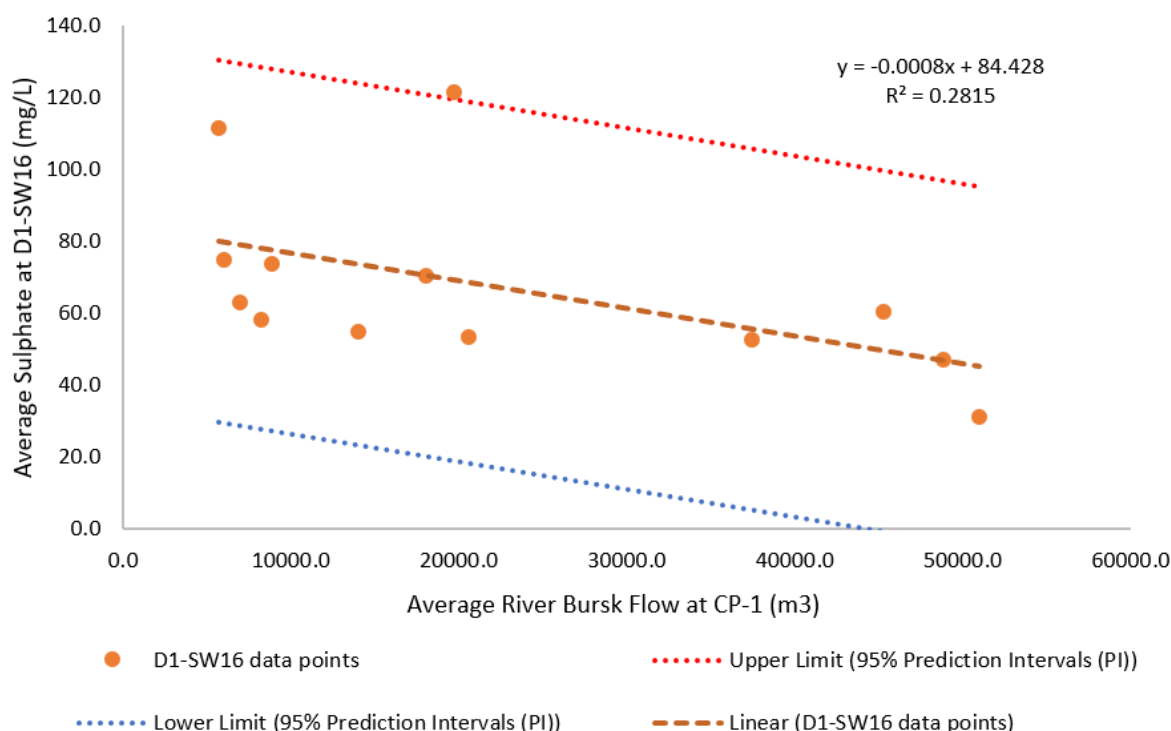
It has not been possible to carry out a regression analysis for D4-SW5 because the provided data since the change of water management contains only three data points. The regression analysis for monthly River Bursk flows and monthly mean sulphate concentrations at D1-SW12 (5.6 km downstream of the mine water discharge point and in the River Glyde) gives a higher correlation coefficient of 0.5931 (Graph 6.4). This may be because sulphate concentration is further diluted by the flow rates in the River Glyde as well as the River Bursk, which may remove more extreme and / or outlier values. The regression suggests that predicted monthly average sulphate concentration at D1-SW12 at hypothetical zero flow in the River Bursk, would be 142.3 mg/L sulphate. However, there are several large deviations from the regression line in the available data points, of up to approximately 60

mg/L higher than predicted. The 95% prediction interval upper limit at hypothetical zero river flow is 204.8 mg/L and the lower limit is 79.7 mg/L.



Graph 6.4 Average Sulphate at D1-SW12 per month vs average River Bursk flow at CP-1 per month between October 2018 and October 2019.

The regression analysis for monthly River Bursk flows and monthly mean sulphate concentrations at D1-SW16 (16 km downstream of the mine water discharge point and in the River Glyde) gives a lower correlation coefficient of 0.28 (5). This is may be because D1-SW16 is considerably further downstream on the River Glyde, with a much larger catchment affecting sulphate concentration. The regression suggests that predicted monthly average sulphate concentration at hypothetical zero flow in the River Bursk would be 84.4 mg/L sulphate. There are however two large deviations from the regression line in the available data points, of up to approximately 60 mg/L higher than predicted. The 95% prediction interval upper limit at hypothetical zero river flow is 134.8 mg/L and the lower limit is 34.1 mg/L.



Graph 6.5 Average sulphate at D1-SW16 per month vs average River Bursk flow at CP-1 per month between October 2018 and October 2019.

6.4.5 Impacts on European Designated Sites

A NIS was prepared by AECOM to provide the competent authority with the necessary information to carry out an Appropriate Assessment (AA) for the Proposed Licence Amendment. It initially concluded that there was no Likely Significant Effect on Killyconny Bog SAC (largely because of its location in a different water catchment to that of the mine site and factory site), but that there were Likely Significant Effects on Dundalk Bay SAC, Dundalk Bay SPA and Stabannan-Braganstown SPA that required further investigation through Appropriate Assessment. The Appropriate Assessment concluded that the Proposed Licence Amendment, individually or in combination with other plans or projects, will not adversely affect the conservation objectives of Dundalk Bay SPA, Dundalk Bay SAC or Stabannan-Braganstown SPA, and therefore that there will be no adverse effect on the integrity of any European site (AECOM, 2020). This was primarily on the basis that:

- Water quality monitoring data from October 2018 until at least October 2019 submitted by SGCPIL, covering the period since the change of water management and including summer low river flow periods (including Compliance Point CP-1 70 m downstream of the discharge point, D4-SW1 2.2 km upstream, and D1-SW16 16 km downstream), showing that levels of sulphate, calcium and conductivity at D1-SW16 were below limits for both drinking water and protection of groundwater (based on EPA 2003 guidance)
- The expectation that the future mine water discharge rate will be similar to that during the above water quality monitoring period, but also accounting for the slightly higher maximum sulphate concentration previously predicted at Compliance Point CP-1 and the higher requested sulphate concentration for licensing purposes, which result in estimated sulphate concentrations at D1-SW16 that slightly exceed the 200 mg/L limit for groundwater (in EPA, 2003) but are below the drinking water limit of 250 mg/L and well below the recommended limit for protection of aquatic life of 309 mg/L at the water hardness of these watercourses stated in BC (2013)
- The substantial dilution effects of the mine water discharge (and of discharges of other projects with potentially similar discharges in the same catchment) caused by merging tributaries and (in the case of Dundalk Bay SPA and SAC) significant tidal flushing in an estuarine environment, downstream of D1-SW16 over distances of 11 km and 22 km for Stabannan-Braganstown SPA and Dundalk Bay SPA / SAC respectively, and
- The location of the downstream River Glyde along a small part of the edge of Stabannan-Braganstown SPA rather than within it, with water not normally entering the SPA except during flood conditions when dilution effects will be still greater; and, the existing heavy agricultural management in this SPA.

Note that because the relevant European sites are along or beyond the River Glyde downstream of the confluence with the River Bursk, they are subject to discharges from both the mine site and the factory site, and monitoring points D1-SW12 and D1-SW16 necessarily account for both.

Given that the NIS concluded no adverse effects on the integrity of European sites, it is correspondingly concluded for assessment under the EIA Directive (as amended) that there will be no effect on European sites.

6.4.6 Impacts on Nationally Designated Sites

Ballyhoe Lough pNHA

Note that because this pNHA is along the River Glyde downstream of the confluence with the River Bursk, it is subject to discharges from both the mine site where the Proposed Licence Amendment applies, and the factory site, and monitoring point D1-SW12 necessarily accounts for both. Ballyhoe Lough pNHA is located relatively close to monitoring point D1-SW12, which is approximately 530 m downstream of the pNHA. The pNHA is 2.25 km downstream of the confluence of the River Bursk with the River Glyde. The pNHA includes a small tributary that approaches from the south-west that will provide a degree of further dilution of the main aquatic section of the pNHA (Ballyhoe Lough itself). However, all dilution factors are accounted for at D1-SW12 because it is located shortly downstream of the pNHA with no other intervening tributaries. It is therefore reasonable to assume that water quality in Ballyhoe Lough pNHA will be similar to that at D1-SW12.

Although sulphate concentration measurements on a single day may exceed 309 mg/L (up to potentially 352 mg/L) at D1-SW12, regression analysis (see Section 6.4.4) suggests that at a theoretical zero river flow rate, mean sulphate level per month (sulphate monitoring as recommended by BC (2013)) at D1-SW12 and by extension at the pNHA would be approximately 142.3 mg/L, and would normally be lower since the watercourses (in particular the large River Glyde downstream of the River Bursk) never actually reach zero flow. However, the regression is based on limited data and significantly higher sulphate levels were at times recorded in the period October 2018 to October 2019. The largest recorded deviation was approximately 60 mg/L higher. Such a deviation could result in a sulphate level in the order of 200 mg/L with a 95% upper prediction limit of 204.8 mg/L sulphate per month. Given the conclusion above that 6% of months (based on the last twenty years of rainfall data) could be expected to experience lower rainfall and therefore lower river water flow than that in the October 2018 to October 2019 period, future mean monthly sulphate level at the pNHA could reasonably be expected to exceed this in 0.72 months per year.

It is considered reasonable to assume that the degree of deviation at such lowest river flows is unlikely to exceed twice the predicted level, giving a worst-case scenario of 285 mg/L mean monthly sulphate concentration. This worst-case scenario is below the 30-day mean sulphate level of 309 mg/L recommended in BC (2013) for general protection of aquatic life at the degree of water hardness of the River Bursk / Glyde, and it is reasonable to expect sulphate levels to normally be considerably lower.

Consequently, it is considered that there is likely to be negligible effect on Ballyhoe Lough pNHA.

Stabannan-Braganstown pNHA

Note that because this pNHA is along the River Glyde downstream of the confluence with the River Bursk, it is subject to discharges from both the mine site where the Proposed Licence Amendment applies, and the factory site, and monitoring point D1-SW16 necessarily accounts for both. Stabannan-Braganstown pNHA contains and is larger than Stabannan-Braganstown SPA. The habitats that it encompasses in its greater extent are heavily managed agricultural fields and although details for the pNHA do not specify the precise bird species for which it is designated, it is assumed given the included SPA that the interest is also greylag goose.

Although the River Glyde flows through the pNHA, rather than along a part of the edge in the case of the SPA, the same arguments applied in the NIS (AECOM, 2020) to the SPA are also applicable to the pNHA, the most important being that: a) the fields are heavily managed for agricultural purposes such that activities such as ploughing, seeding, fertilising and harvesting will have far more drastic effects on vegetation than any diluted sulphate in the river water; b) river water at this point is well downstream of D1-SW16 where water quality is expected to be satisfactory and sulphate level certainly below 309 mg/L as recommended at this water hardness in BC (2013); and c) the water in any case does not enter the fields used by greylag geese except in flood conditions when the degree of dilution will be larger still.

Consequently, there is expected to be no effect on Stabannan-Braganstown pNHA.

Dundalk Bay pNHA

Note that because this pNHA is beyond the River Glyde downstream of the confluence with the River Bursk, it is subject to discharges from both the mine site where the Proposed Licence Amendment applies, and the factory site, and monitoring point D1-SW16 necessarily accounts for both. Dundalk Bay pNHA is coincident with Dundalk Bay SAC.

Both Dundalk Bay SAC and SPA were assessed in the NIS (AECOM, 2020). The NIS concluded that there would be no adverse effect on the integrity of any European sites, including Dundalk Bay SAC and SPA as already summarised in Section 6.4.5 above. No site synopsis or designation information for Dundalk Bay pNHA was found during the desk study, but it is assumed that the interests are those of the SAC / SPA and potentially additional non-SCI bird species that use the estuary. Any non-SCI bird species would be expected to be unaffected for the same reasons set out in Section 6.4.5 and the NIS for SCI bird species.

Given that the pNHA also coincides with Dundalk Bay SAC in its entirety, it is concluded that there will be no effect on the Dundalk Bay pNHA.

pNHAs Upstream of Confluence with River Glyde

Note that because these pNHAs are along the River Glyde upstream of the confluence with the River Bursk, they are subject to discharges from the factory site, but not from the mine site where the Proposed Licence Amendment applies except insofar as such discharge might impede movement of fish, as discussed below. Breakey Loughs pNHA, Corstown Loughs pNHA, Monalty Lough pNHA, Lough Naglack pNHA, and Lough Fea Demesne pNHA are within tributaries of the River Glyde upstream of the confluence with the River Bursk. They cannot be directly affected by the discharge, but the discharge in theory could inhibit passage of migratory fish. Migratory fish may constitute prey resources for the designated bird interests of these pNHAs (in general, the species involved are not specified but include waterfowl, which may be piscivorous, and in one case heron which is piscivorous).

However, movement of fish is not likely to be prevented within the River Glyde downstream of the mine water discharge based on the literature review of sulphate impacts on fish (Section 6.4.3.1) and in particular the predicted and current sulphate concentrations in the River Glyde (Section 6.4.4), which are significantly lowered by the River Glyde itself as the primary source of dilution.

The literature review suggests that eggs and other young stages of fish are most vulnerable to pollution and provides evidence that adult fish are unlikely to suffer significant effects in the River Glyde nor be prevented from swimming through the affected stretch. For example, significant mortality of young stages of salmonids was reported at around 400 mg/L and above, levels which are not reached in the River Glyde, and 50% of adult minnow (small fish which are considered to indicate good water quality, in contrast to sticklebacks which occur locally and can tolerate polluted water) were reported to survive sulphate at over 4,500 mg/L, a level far beyond that which could occur in the River Glyde.

Moreover, fish populations known to occur in the local area include many that are not migratory, such as three-spined stickleback, perch, roach, tench and pike. At least some of these fish can be expected to be present and resident at these pNHAs and would not be subject to any effects of the discharge and would therefore always be available as fish prey resources for the pNHA bird interests.

Therefore, it is concluded that there will be no effect on Breakey Loughs pNHA, Corstown Loughs pNHA, Monalty Lough pNHA, Lough Naglack pNHA, and Lough Fea Demesne pNHA.

6.4.7 Impacts on General Freshwater Habitat

Freshwater habitat that is most likely to be significantly adversely affected by the discharge to which the Proposed Licence Amendment applies is situated between the mine water discharge point and the confluence of the River Bursk with the River Glyde. This is for the reasons set out above for Ballyhoe Lough pNHA above, which utilise monitoring point D1-SW12 in the River Glyde (note that monitoring point D1-SW12 necessarily accounts for both the mine and factory site discharges because it is downstream of both).

Additionally, there are no significant tributaries between the mine water discharge point and confluence, as suggested by the fact that sulphate levels at D4-SW5 (between Bursk Lough and Rahans Lough, the confluence with the River Glyde being just after Rahans Lough) appear to be essentially the same as at Compliance Point CP-1 (see Section 6.4.4, Table 6-5; Graph 6-1) the difference is small enough to be attributable to measurement error). Regression analysis of mean monthly River Bursk flow rate and sulphate level at Compliance Point CP-1 (see

Section 6.4.4, Graph 6-2) suggests that at theoretical zero flow (which does not occur) mean monthly sulphate level would be 464.7 mg/L. However, the regression is based on limited data and significantly higher sulphate levels were at times recorded in the period October 2018 to October 2019, notably 762 mg/L in October 2018 with a deviation from the regression line of approximately 300 mg/L.

Given the conclusion in Section 6.4.4 that 6% of months could be expected to experience lower rainfall and therefore lower river water flow than that in the October 2018 to October 2019 period (based on twenty years of rainfall data), future mean monthly sulphate level in the River Bursk could reasonably be expected to exceed this in 0.72 months per year (Table 6-4) .

The literature review noted whilst some aquatic invertebrates appear to be relatively unaffected by sulphate levels below 1,000 mg/L, pollution-sensitive species such as mayflies, stoneflies and caddisflies were found by Timpano *et al* (2010) to decline in diversity at sulphate levels from 200 mg/L upwards, and although this level could be raised to 309 mg/L based on BC (2013) for the water hardness in these waterbodies, sulphate levels would frequently exceed 309 mg/L – data for October 2018 to October 2019 show that sulphate levels were above this limit at Compliance Point CP-1 for five months of the year.

Given also that historic rainfall data (see Section 6.4.4, Table 6-4) suggests that 6% of future months could be expected to experience lower rainfall than recorded in the October 2018 to October 2019 monitoring period, it is considered reasonable to assume adverse sulphate levels for macroinvertebrates are likely to occur for 5-6 months of the year. This frequency of adverse sulphate levels is likely to adversely affect macroinvertebrate diversity in the River Bursk, at Bursk Lough and at Rahans Lough, in particular through loss of pollution intolerant taxa such as caddisflies, mayflies and stoneflies (see Section 6.4.9).

This is supported by the results of the macroinvertebrate survey which suggest that there is a degree of adverse effect on macroinvertebrates in the River Bursk from the mine water discharge on top of the likely larger effects of agricultural run-off. Adverse sulphate levels may also in the long-term cause adverse changes in vegetation diversity, a possibility that cannot be ruled out given the literature research (see Section 6.4.3); for example, sulphate can increase sulphide production and susceptibility to eutrophication (already a known issue identified by EPA, owing to agricultural run-off) which in turn is liable to encourage dominance of competitive species and concomitant decreased plant diversity. This would be particularly significant for Rahans Lough since desk study information indicates that it is of sufficient quality to have been considered for NHA status, containing notable freshwater habitats such as mesotrophic open water, sedge / reed swamp and wet woodland.

Arguments given for Ballyhoe Lough pNHA above concluded that mean monthly sulphate levels at D1-SW12 were unlikely to exceed 280 mg/L, and that this would be infrequent. There is only one tributary between the confluence of the River Bursk with the River Glyde and D1-SW12, which is a minor one located largely within Ballyhoe Lough pNHA. Therefore, it is assumed that sulphate levels in the stretch of the River Glyde between the confluence with the River Bursk and D1-SW12 will be similar, but slightly higher, than at D1-SW12 (note that monitoring point D1-SW12 necessarily accounts for both the mine and factory site discharges because it is downstream of both). As such, it is considered unlikely that mean monthly sulphate levels in the River Glyde will exceed the limit of 309 mg/L advised in BC (2013) for the water hardness in the River Glyde. It is therefore reasonable to expect no significant effect in the River Glyde.

However, in view of the County level importance assigned to the overall habitats of the River Bursk, Bursk Lough and in particular Rahans Lough, there is considered to be a possible permanent adverse effect of County (medium in NRA terminology) significance on freshwater habitats.

6.4.8 Impacts on Fish Populations

As noted above, conditions in the River Glyde are not expected to exceed the limit for mean monthly sulphate level of 309 mg/L advised in BC (2013) for the water hardness of the River Glyde (note that monitoring point D1-SW12 referred to in respect of sulphate levels in the River Glyde necessarily accounts for both the mine and factory site discharges because it is downstream of both). Therefore, fish populations in the River Glyde are not expected to be significantly affected.

As discussed above in respect of freshwater habitats, mean monthly sulphate levels are liable to be frequently above 309 mg/L in the downstream River Bursk, Bursk Lough and Rahans Lough, at times substantially so. Chronic sulphate levels, measured as 30-day averages, are liable to be at level (above approximately 400 mg/L) which (see Section 6.4.3.1) would appear likely to cause mortality of the youngest stages of fish for a few months per year, potentially several months in years of lower rainfall than was experienced in the October 2018 to October 2019 monitoring period.

However, the fish survey (SLR, 2019d) indicates that there is no salmonid spawning or nursery habitat in the downstream River Bursk, therefore the youngest stages of salmonids are assumed not to occur in this stretch. Available desk study information (see Section 6.4.3.1) suggests that adult fish, likely including salmonids, are more resistant to sulphate. This is supported by the reported occurrence of brown trout at Compliance Point CP-1 shortly downstream of the discharge point (SLR 2019b), the apparent much greater resilience of adult fathead minnows compared to the eggs and recently-hatched fish of this species, and also by the Chapman *et al* (2000) study which found no effect eggs / young fish of a salmonid during short-term exposure at 1,450 mg/L sulphate.

With regard to the latter study, although an effect on the eggs / young stages would be expected at a lower sulphate concentration under chronic (long-term) exposure, the adult salmonid fish in this study would at minimum also be likely to tolerate these high sulphate levels, at least in the short term. This concentration is higher than the proposed sulphate limit of 1,250 mg/L, and such concentrations are expected to occur rarely if ever in the River Bursk, including during the key migratory period for salmonids of October to January. Therefore, no significant effect is considered likely on salmonids, both in terms of breeding and migrating.

European eel were recorded at the mine discharge point in SLR (2019d). European eel live their adult life in freshwaters between a variety of habitats, migrating downstream to the Sargasso Sea to spawn. They are known to withstand harsh environments and moderate pollution and it is unlikely that the expected sulphate levels will have adverse effects on their survival.

Brook lamprey require good water quality. However, although they were recorded upstream of the mine water discharge point (SLR, 2019d), they were not found downstream and spawning habitat downstream of the discharge point was categorised as poor (SLR, 2019d). Although brook lamprey do not migrate to the sea or estuaries as do other lampreys, they do migrate upstream after metamorphosis to find suitable spawning substrates (Maitland, 2003). However, since reaches downstream of the discharge were considered poor for lamprey (SLR, 2019d), they would not be expected to move through the affected stretch of the River Bursk. Therefore, brook lamprey are expected to be largely or entirely absent from the downstream River Bursk. Given also that sulphate levels are expected to be below the 309 mg/L limit recommended in BC (2013) in the River Lagan / Glyde, no significant adverse effect is expected on brook lamprey.

Coarse fish (roach, pike, perch) were the dominant species in the downstream section of the River Bursk (SLR, 2019d) and Rahans Lough. The latter is a popular angling waterbody and is expected to be stocked. These coarse fish species are not of protected or notable importance. Nevertheless, a good fish community structure is important because it represents a healthy aquatic ecosystem and can be seen of value for this reason. Being mobile, adult coarse fish can be expected to move away from areas affected by adverse sulphate levels, but sulphate concentrations above approximately 400 mg/L (see Section 6.4.3.1) are assumed likely to have an adverse impact on the eggs and younger stages of coarse fish, which may in turn adversely affect recruitment in the stretch of the River Bursk downstream of the discharge point, including Rahans Lough.

Mean monthly sulphate concentrations of this magnitude in the downstream River Bursk are likely to occur for a few months per year and therefore a degree of adverse effect is considered possible on populations of coarse fish that are not pollution tolerant in the River Bursk. This would likely include perch, pike, roach and stone loach, but is less likely to include bream, tench and three-spined stickleback which can tolerate poor water quality.

Consequently, there is considered to be a possible permanent adverse effect of Local significance on fish populations, with respect to coarse fish only.

6.4.9 Impacts on Macroinvertebrate Populations

As discussed above for freshwater habitats, the sulphate levels that can be expected in the downstream River Bursk and on-line loughs are sufficient to cause a decrease in diversity, based on a study (Timpano 2010) which found that in particular pollution-intolerant invertebrates (mayflies, caddisflies and stoneflies) were likely to suffer a decrease in diversity above 200 mg/L sulphate, and supported by the macroinvertebrate survey which suggests a degree of adverse effect from the mine water discharge on top of the likely larger effects of agricultural run-off.

It should be noted that that Timpano *et. al.* (2010) study investigated acute (short-term) toxicity, and that chronic exposure (such as a permanent mine water discharge), is likely to have a greater adverse effect at such concentrations, or a possible effect at higher concentrations.

The level in this study of 200 mg/L can arguably be raised to 309 mg/L based on the water hardness in the River Bursk / Glyde, as per BC (2013). These sulphate levels are expected to be exceeded in the River Bursk, Bursk Lough and Rahans Lough for five to six months of the year. The degradation of the macroinvertebrate population

can be expected, based on the arguments given under freshwater habitats above, to extend from the discharge point to the confluence with the River Glyde (note that monitoring point D1-SW12 referred to in respect of sulphate levels in the River Glyde necessarily accounts for both the mine and factory site discharges because it is downstream of both).

Since no rare or protected macroinvertebrates have been recorded or found in this area (records of freshwater white-clawed crayfish within 5 km of the factory site are in a different sub catchment and therefore could not be affected), and the affected stretch is relatively small (2.3 km) compared to the length of the River Bursk, and lack of expected effect in the River Glyde, the effect on macroinvertebrates is, however, considered to be locally important only.

Consequently, there is expected to be a permanent adverse effect of Local significance on macroinvertebrates.

6.4.10 Impacts on Otter Population

Otter is a European Protected Species. The only likely impact on otter is through effects on foraging resources. No impact is considered likely directly upon otters from sulphate in the water, nor are impacts possible on refuges. Foraging for inland freshwater otters would primarily comprise fish (otters also forage on amphibians such as frogs, but this tends to be seasonal and less significant than fish). Although a possible adverse effect of local significance only is stated above for fish populations, otter territories are very large along primarily linear waterbodies, in the order of 15-30 km and potentially much longer for male otters (Chanin, 2003).

Only a small proportion of an otter territory could therefore be affected, since effects on fish are not considered likely beyond the affected short stretch of the River Bursk, and moreover several relevant fish species are tolerant of pollution (see above), including European eel, a favoured prey species. Salmonids are also a favoured prey type and are expected to be unaffected owing to lack of spawning habitat in the affected stretch and expectation that adults will be largely unaffected. Therefore, the overall effect on otters is considered likely to be slight, at worst resulting in lower frequency of otter in the 2.3 km of affected watercourse and increased frequency upstream / downstream.

Consequently, there is considered to be a possible permanent adverse effect of Site significance only on otter.

6.4.11 Impacts on Kingfisher Population

Kingfisher territories tend to be in the order of 1-3 km long (Forrester, 2007), such that it is possible that a single entire kingfisher territory could exist within the 2.3 km of affected River Bursk and associated loughs. Kingfishers feed on small fish such as minnows and sticklebacks. The above assessment of effects on fish sets out why those effects are not expected beyond the River Bursk, which also means that whilst the mine water discharge is relevant the factory site discharge is not. At least sticklebacks are present in the River Bursk and are pollution tolerant.

Whilst minnow is not pollution tolerant, it has nevertheless been found during the literature review that 50% of adult minnow can survive sulphate concentration higher than 4,000 m/L, far above the concentration possible from the mine water discharge. Such small fish feed on macroinvertebrates but, as noted above, although an adverse effect on macroinvertebrate diversity is likely, it is not likely that all macroinvertebrates will be removed from the affected section of the River Bursk, since some are pollution-tolerant and a range of taxa were recorded during the macroinvertebrate survey in 2020 (see Volume 3, Appendix A.6.4) and previous survey in 2019 (KD Environmental Ltd 2019). Therefore, it is likely that suitable small fish for kingfisher will continue to exist in the affected stretch of the River Bursk.

Consequently, there is considered likely to be a negligible effect on kingfisher.

6.4.12 Impacts on Bat Populations

All bats are European Protected Species. The only likely impact on bats is through reduction of invertebrate prey along the River Bursk. However, invertebrates along watercourses comprise many that are associated with adjacent bank vegetation (trees, shrubs and herbaceous vegetation) rather than the water itself, and it is also expected that moderate macroinvertebrate diversity will persist given the results of the macroinvertebrate survey carried out in July 2020 (see Volume 3, Appendix A.6.4) and previous survey in 2019 (KD Environmental Ltd 2019). The watercourse itself and adjacent bank vegetation will remain as likely commuting and foraging routes, and there will be no effect on any bat roosts that might be present. Therefore, no significant impact is expected on foraging bats.

Consequently, there is considered to be negligible effect on bat populations.

6.4.13 Impacts on Amphibian Populations

Common amphibians such as common frog and smooth newt are protected under the Wildlife Acts. They are most likely to occur within the affected section of the River Bursk at Bursk Lough and Rahans Lough, both of which offer suitable habitat for breeding and likely suitable adjacent terrestrial habitat. Limited information from the desk study suggests that adults of such species may be little affected at sulphate concentrations below approximately 1,000 mg/L, which as discussed above is expected to occur infrequently in the affected stretch of the River Bursk but never in the River Glyde (see Section 6.4.4, and meaning that the mine water discharge is relevant but not the factory site discharge).

However, common sense would suggest that the eggs, like those of fish, are liable to be more sensitive. Amphibians breed in spring therefore these months are most critical. Generally, rainfall is not very low in spring therefore it is reasonable to expect that normally there will be lower sulphate levels at this time, and therefore that effects on common amphibians will be minor.

Consequently, there is considered likely to be negligible effect on amphibians.

6.5 Mitigation Measures

No mitigation is currently proposed in terms of water quality. None is required in respect of protected species nor is any protected species licensing necessary, since no effects on protected species or their refuges are anticipated.

However, monitoring is proposed in respect of Ballyhoe Lough pNHA. As discussed above, it is thought likely that there will be no effect on Ballyhoe Lough pNHA, because expected mean monthly sulphate levels at D1-SW12 (and hence the pNHA, since it is located shortly upstream) are lower than the mean monthly limit of 309 mg/L recommended in BC (2013) for the degree of water hardness in the River Glyde. However, predictions are based on limited data and this site is of national importance by virtue of its designation at the national level. Therefore, monitoring shall take place as follows:

- Monitoring of water quality shall be implemented on a regular on-going basis in the River Glyde a short distance upstream of Ballyhoe Lough pNHA. 'Regular on-going basis' means at least five times per month at evenly spaced intervals (as recommended in BC (2013)), unless the mine water discharge ceases or is mitigated to much lower sulphate levels. Automated monitoring on a more frequent basis from which monthly means can be calculated should also be acceptable. This will confirm that the mean monthly concentration of sulphate in water entering the lough does not exceed 309 mg/L, and
- In the unlikely event that the quality of water entering Ballyhoe Lough pNHA exceeds the recommended mean monthly sulphate level of 309 mg/L recommended in BC (2013) at the level of water hardness in the River Glyde, then liaison with EPA / NPWS will take place to consider further action. Alternative methods of managing sulphate on site may then be required, which should be in line with any future improvements in technologies for the treatment of sulphate.

6.6 Cumulative Impacts

Cumulative or in-combination effects can result from individually significant but collectively significant actions taking place over a period of time or concentrated in a location (CIEEM, 2018).

Of relevance in this case are projects which involve water discharges into the same water catchment. There are a number of Urban Waste Water Treatment (UWWT) Agglomeration Boundaries that are hydrologically connected to the River Bursk and / or Glyde, but discharges from these are of a different nature to the mine water discharge, and it is considered reasonable to discount possible in-combination effects with those of the Proposed Licence Amendment from these sources.

Based on the EPA maps website, there are several Industrial Emissions Licensing facilities, Integrated Pollution Control (IPC) sites, and IPPC (Integrated Pollution Prevention Control) facilities that are licensed by the EPA and are also hydrologically connected to the River Bursk and / or Glyde. Information and upstream distances for the relevant IEL facilities, IPC sites, and IPPC facilities are as follows:

- Kilmainhamwood Compost waste boundary (W0195-02) to the south of Kingscourt Co. Cavan, which is a composting / anaerobic digestion facility, is located 11.73 km upstream of the confluence of the River Bursk and River Glyde at Rahans Lough
- Kingspan Building Products Limited (P0065-01) and O'Reilly Concrete Ltd. Section 4 discharge point (SS/W006/12) in Kingscourt Co. Cavan is located 6.6 km upstream of the confluence of the River Bursk and River Glyde at Rahans Lough
- Breedon Brick Limited (also known as Kingscourt Brick Limited) (P0528-01) to the east of Kingscourt Co. Cavan, which involves the manufacturing of coarse ceramics from a quarry site, is located 4.5 km upstream of the confluence of the River Bursk and River Glyde at Rahans Lough
- Leslie Rowntree facility (P0866) in a rural area to the south-west of Carrickmacross, which involves the rearing of poultry in installations, is located 5.4 km upstream of the confluence of the River Bursk and River Glyde at Rahans Lough
- Section 4 discharge from O'Reilly Concrete 1 (WP21/13) is located within the River Glyde, and
- JMW Farms (IRL) Limited facility (P0989-01) to the north-east of Tallanstown in Co. Louth is located 3.9 km upstream of the River Glyde.

Based on aerial imagery there are also two mine / quarry sites that appear to be hydrologically connected to the River Glyde that are were not displayed as an industry or waste facility on the EPA maps website. These are:

- A clay pit quarry site near Cormey Bridge in Co. Cavan is owned by Kingscourt Bricks Ltd and covered under EPA licence P0-528-01 (Planning Application no. 1775 received permission in 2017). It is located 1.2 km to the south of the SGCPIL Knocknacran open-pit mine, 3.2 km upstream of the confluence of the River Bursk and River Glyde at Rahans Lough, and,
- The other mine / quarry site in Co. Meath is operated by Roadstone Barley Hill Ready-Mix Concrete Supplier, but there is no information available on this mine / quarry from the Meath County Council planning application website. The site is located 1.1 km to the west of the Ballyhoe Lake and River Glyde.

Of the above, some are considered not relevant because they involve dissimilar discharges from agriculture or fundamentally different industrial facilities. The majority are also upstream of monitoring point D1-SW12 and D1-SW16 and discharges from these are therefore already accounted for within the baseline water quality monitoring data.

Those projects / facilities that would not be accounted for in the water quality monitoring data and may produce discharges that include sulphates / calcium include the clay pit quarry site and two of the concrete facilities, although these are (or are assumed to be or will be) subject to EPA licences that will include preservation of drinking water quality at Tallanstown.

The substantial dilution effects discussed above resulting from confluences with other watercourses, such as the River Glyde, and (in respect of sites at Dundalk Bay) from the tidal environment at Dundalk Bay also apply to discharges from these existing or proposed facilities. Consequently, it is not considered that there is any possibility of cumulative effects on ecological features as a result of these sites and facilities.

6.7 Residual Impacts

In the absence of mitigation, the residual impacts are the same as those set out in the impact assessments above.

6.8 Difficulties Encountered

The principal difficulty for this assessment was the prediction of future sulphate levels at the various water quality monitoring points. This was in part because of the relatively small dataset available for actual sulphate values since the change in water management, but also for the inherent difficulty in assessing possible future sulphate levels which may exceed those in the October 2018 to October 2019 period as a result of occasional lower river flows.

6.9 Summary

The Biodiversity impact assessment is based on desk study research and the results of a macroinvertebrate survey carried out in July 2020. The desk study included: review of existing fieldwork reports and other studies associated with the mine site; literature review on effects of relevant water parameters on ecological features; and investigation into possible future pollutant concentrations, taking into account the limited monitoring data available since the change of water management in 2018, and possible river flow variation beyond that period. It also accounts for discharges from the factory site.

No impacts are anticipated on European sites. The reasons for this are set out in detail in the NIS (AECOM 2020), but primarily involve low measured and predicted sulphate levels at and therefore beyond monitoring point D1-SW16 on the River Glyde, major dilution effects in the estuary of Dundalk Bay, and the fact that river water will only enter Stabannan-Braganstown SPA during flood conditions when further dilution will occur. Note that monitoring point D1-SW16 accounts for both the mine site and factory site because it is downstream of both.

With respect to nationally-designated sites, no impact is anticipated on Stabannan-Braganstown pNHA for similar reasons to those of the SPA. Although other pNHAs exist upstream of the discharge or the confluence of the River Bursk with the River Glyde, no impact is considered possible on these pNHAs because the discharge cannot reach them and either a) they have no aquatic interests, or b) whilst some have bird interests known to or potentially including fish-eating species, no effect is considered likely on movement of fish towards the pNHAs through watercourses downstream of the discharge, and non-migratory fish would in any case be unaffected.

Ballyhoe Lough pNHA is located on the River Glyde 5.6 km downstream of the discharge, but adverse effects are considered unlikely given that maximum measured and predicted mean monthly sulphate concentration just beyond Ballyhoe Lough approach but are below the mean monthly limit of 309 mg/L (the limit recommended in BC (2013) at the water hardness of the River Bursk and River Glyde). However, given its national importance, monitoring of water quality just upstream of Ballyhoe Lough pNHA is proposed in order to verify continued acceptability of water quality entering the pNHA, and to consider action in liaison with EPA / NPWS in the unlikely event that mean monthly sulphate exceeds 309 mg/L at this monitoring point.

Impacts are expected to occur on non-designated general freshwater habitat. The extent of significant impacts is not expected to exceed the confluence of the River Bursk with the River Glyde, because primary dilution appears to take place at this confluence: mean monthly sulphate concentration does not appear to change before the confluence, but drops significantly by monitoring point D1-SW12 on the River Glyde, and there is no significant tributary between the confluence and D1-SW12. Taking into account rainfall records for the last twenty years, it is expected that 6% of future months will experience lower river water flow than recorded in the monitoring period of October 2018 to October 2019, and mean monthly sulphate concentration is considered likely to exceed 309 mg/L (as recommended by BC 2013) in five to six months of the year for the 2.3 km of the River Bursk between the discharge and the confluence with the River Glyde.

Freshwater habitats in this stretch comprise the River Bursk itself plus Bursk Lough (which is vegetated and small) and Rahans Lough (which includes mesotrophic open water, swamp / reed habitats and wet woodland and is of sufficient quality to have been considered for NHA status). Literature review indicates that prolonged adverse sulphate exposure is liable to adversely affect plant diversity, and effects are also likely on macroinvertebrates (see below). Therefore, there is considered to be a possible permanent adverse effect of County significance on overall freshwater habitat.

Impacts on macroinvertebrates and fish are considered to potentially be of Local significance. This results from an expectation that the downstream section of 2.3 km of the River Bursk and associated loughs are liable to suffer reduced macroinvertebrate diversity in particular of pollution intolerant species (including caddisflies, mayflies and stoneflies), and possible adverse effect on the eggs and younger stages of less pollution tolerant fish species. The possibility of a degree of adverse effect on macroinvertebrates beyond that of likely existing effects from agricultural run-off is supported by the macroinvertebrate survey carried out in July 2020, which suggests a decrease in pollution intolerant species and an increase in pollution tolerant species downstream of the mine site discharge point, which appeared partially alleviated nearer Rahans Lough and is expected to be insignificant following substantial dilution at the confluence with the River Glyde.

No significant effect is considered likely on salmonids, because there is a reported lack of spawning habitat downstream of the discharge and therefore assumed absence of vulnerable younger stages, and adult salmonids are likely to be unaffected. Brook lamprey, which is not migratory, is also not expected to be affected owing to a lack of spawning habitat downstream of the discharge and likely lack of effect on adults. European eel is not

considered likely to be affected because it has a high tolerance to poor water quality and breeds at sea. Adverse effects are considered more likely on eggs or younger stages of pollution intolerant coarse fish present at this locality, which include roach, perch and pike.

There is expected to be at most an adverse effect of Site significance only on otter (if fish prey are locally reduced) owing to the large home range of otters and expectation that several fish species are likely to be unaffected, including favoured prey such as salmonids and European eel.

Impacts on kingfisher (which prey on small fish), bats (which prey on aerial invertebrates) and amphibians (likely to utilise wetland habitat at Bursk Lough and Rahans Lough) are expected to be negligible.

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7 Land and Soils

7.1 Introduction

This chapter describes the baseline land and soils aspects of the mine and factory site and surrounding areas. The chapter defines the study area, and the methodology used for developing the description of the baseline environmental conditions in relation to land and soils.

Where relevant, potential impacts of the Proposed License Amendment on land and soils are identified and mitigation measures are proposed.

7.2 Methodology

This land and soil assessment was prepared in accordance with the EPA 'Guidelines on the Information to be contained in Environmental Impact Statements, 2002', 'Advice Notes on Current Practice (in preparation of Environmental Impact Statements)', the "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA Draft August 2017).

The methodology used to assess potential land and soils impacts arising from the Proposed Licence Amendment was as follows:

- A review of the area surrounding the mine and factory was undertaken
- A review of the existing EIAR, and
- An EPA licence review to determine any potential land and soil impacts arising from the Proposed Licence Amendment.

7.2.1 Sources of Information

In order to gather soil and geological baseline information for the study area and to identify the environmental sensitivity and setting of the application site, a desktop study has been undertaken by AECOM with the following sources of information consulted:

- Ordnance Survey of Ireland (OSI) website¹² for historical maps of 1:2,500 scale and 1:10,560 scale (1837 to 1913) and aerial photographs (1995, 2000, 2005)
- Geological Survey of Ireland (GSI) 'Spatial Resources Viewer'¹³
- Environmental Protection Agency (EPA) Map Viewer¹⁴ for land use information, as well as EPA Integrated Pollution Control (IPC) Industrial Emissions (IE) licensed facilities or EPA licensed waste facilities
- National Parks and Wildlife (NPWS) website Map Viewer¹⁵, and
- Teagasc Irish Soils Information System¹⁶.

In addition, previous site investigation reports and documentation provided on the EPA licence website were reviewed, including:

- RPS, November 2018, *Landfill Closure, Restoration and Aftercare Management Plan (CRAMP)*, prepared for Saint-Gobain Construction Products (Ireland) (RPS 2018)
- Minerex Environmental Limited, April 2020, *Annual Groundwater Monitoring Report for Mine and Processing Site for 2019*, prepared for Saint-Gobain Construction Products (Ireland) (Minerex 2020)
- SGCPI, 2019, Annual Environmental Report (AER) 2019, prepared for EPA licence P0519-03 (SGCPI 2019).

¹² [Ordnance Survey Ireland](#) – accessed 31 June 2020

¹³ [GSI Spatial Resources Viewer](#) - accessed 3 August 2020

¹⁴ [EPA Map Viewer](#) - accessed 3 August 2020

¹⁵ [NPWS Map Viewer](#) - accessed 3 August 2020

¹⁶ [Teagasc Irish Soils Information System](#) accessed 3 August 2020

A site walkover to gain a general understanding of the sites was undertaken on 29 January 2020.

7.2.2 Legislation and Guidance

The following relevant policy and legislation that informed this chapter is listed in Table 7-1.

Table 7-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
European Union Water Framework Directive (2000/60/EC).	The following legislation in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programmes in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments: • European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003); • European Communities Environmental Objectives (Surface Water) Regulations, 2009 (S.I. No. 272 of 2009 as amended); • European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010 as amended); • European Union (Drinking Water Regulations, 2014 (S.I. No. 122 of 2014 as amended); and • European Union (Radioactive Substances in Drinking Water) Regulations, 2016 (S.I. No. 160 of 2016).
Environmental Protection Agency	• EPA, Guidelines on the Information to be Contained in Environmental Impact Statements (2002); • EPA, Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2003); • EPA, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (2003); and • EPA, Draft guidance document "Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017).
Additional Guidance	• Groundwater Directives 80/68/EEC and 2006/118/EC); • Institute of Geologists of Ireland (IGI), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013); • Management of Contaminated Land and Groundwater at EPA Licensed Sites (2013); and • Local Authority planning guidance as applicable.

7.2.3 Significance / Evaluation Criteria

The Proposed License Amendment relates to a change in the ELV for sulphate (from 200 mg/L to 1,250 mg/L) and electrical conductivity (from 1,000 µS/cm to 2,360 µS/cm) at Compliance Point CP-1 at the mine site only and does not look to introduce any physical changes to the factory or mine site. It has been determined that a detailed land and soil assessment was not required and as such a methodology outlining significance and evaluation criteria has not been included within this chapter.

7.2.4 Limitations in the Methodology and Gaps in Information

The baseline was based upon information produced by others and on information that was available online at the time of writing. No detailed site walkover or viewpoint assessment has been undertaken as part of the assessment. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the land and soils conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM unless expressly stated.

7.3 Description of the Existing Environment

7.3.1 Existing Environment & Baseline Information -The Mine Site

7.3.1.1 Site History

The open-pit mine at Knocknacran (referred to as Knocknacran Quarry) has been in operation since 1989 producing between 300,000 and 500,000 tonnes of gypsum per annum. The open pit mining operations commenced in the south-eastern portion of the site in 1989 prior to extending to the north and northeast of the site near the boundary of the R179 by 2000.

To supplement resources and recovery of gypsum, planning permission was granted in 2004 by Monaghan County Council (Planning permit, 07430) for extraction of gypsum from underground (referred to as Drummond mine) and commenced full production in 2006. The underground mine is circa 114 ha covering two underground seams (an upper and lower seam).

In 2017, planning permission was granted by Monaghan County Council (Planning permit, 17217) to continue extraction of gypsum deposits from the open pit mine over an area of 54.86 ha including progressive restoration and associated site works. The planning permits did not cover changes to the factory site and stated all materials extracted were to be hauled via an internal service route to a separately permitted processing facility approved under planning references 05/1245, 03/578 and 86/415.

Activities at the mine and factory site have been operated under an Industrial Emissions (IE) licence since 2002. A revised licence was issued in 2005, which was subject to three subsequent technical amendments. The IE details the site emission requirements and discharge points, including water emission to the River Bursk (Glyde_030).

Gypsum deposited within the Kingscourt formation has been subject to extensive historical mining in the region, including the nearby decommissioned Drumgoosat underground mine. The Drumgoosat underground mine is located to the north / northwest of Knocknacran Quarry extending to depth of circa 140 m below ground level.

As part of the Water Management Plan for the mine, the decommissioned Drumgoosat underground mine was utilised to store mine water to manage discharge to the River Bursk. This storage system allowed the mine to temporarily store the groundwater until suitable flow conditions for release occurred.

The decommissioned Drumgoosat Mine provided an area for mine water storage during periods of low flow in the River Bursk that could be incorporated into the overall mine water management procedure. However, following the unexpected water ingress into Drummond Mine on the 22nd June 2018 and the Drumgoosat Mine subsidence which occurred on the 23rd September 2018, it has been decided not to store water in Drumgoosat Mine and all site mine water from Drummond Mine, Drumgoosat Mine and Knocknacran Open Mine has been discharged directly off site to the existing discharge point on the River Bursk. Water discharged from the Drummond mine is natural groundwater which has come into contact with the gypsum associated minerals underground. The discharge water does not include any process water or effluent from onsite operations.

7.3.1.2 Site Infrastructure

The mine site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite. The majority of the site comprises of open pit and underground mining with the infrastructure primarily localised around the buildings and lagoons to the south of the site.

As part of the licence requirements the mine site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three year basis with frequent visual inspections. A review of the 2019 Annual Environmental Report (AER) suggested all bunds and containment systems were in acceptable condition.

Septic waste water at the mine site is handled by an independent septic tank system.

Detailed information regarding materials assets on the site is provided in Chapter 14. Material Assets.

7.3.1.3 Geology

Data and information relating to the geology of the mine site was derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the client. Additional data was obtained from the websites listed in Section 7.2.1.

Overburden Geology / Teagasc soils

According to the EPA mapping tool, the subsoils in the areas surrounding the mine consists of made ground and till derived from lower Palaeozoic sandstones and shale.

The overburden and till has been stripped from the site surface area to allow for the open pit mining operations. These deposits are being used during the ongoing phased restoration of the site.

Bedrock Geology

Data relating to the geology and hydrogeology of the site was derived from the online GSI Spatial Resource Viewer.

Three bedrock geological units are identified in the vicinity of the site, as follows:

- Kingscourt Gypsum Formation, consisting of mudstone with gypsum and anhydrite units, containing six members of basal conglomerate member (up to 18 m thick), a lower mudstone, a lower gypsum, a middle mudstone, an upper gypsum (6 – 10 m) and a final upper mudstone unit
- Kingscourt Sandstone Formation, consisting of red sandstone, containing red basal siltstone member and three red sandstone member, the middle sandstone member is impersistent and known from only a few boreholes containing marine acritarchs and foraminifera, and
- Cabra Formation, consisting of interbedded sandstone and shale. A thick sandstone unit (circa 15 m) occurs near the middle of the formation.

The extents of the current mine site is underlain by the Kingscourt Gypsum Formation, which is distributed in a north-south oriented belt 12 km in length and 1.2 km wide. The site boundary encompasses the width of the formation. The Kingscourt Gypsum Formation is underlain by Carboniferous undifferentiated micaceous shale, siltstone and sandstone with occasional thin coal beds of Westphalian and Namurian age, these do not outcrop in the mine site. A typical stratigraphic column of the area is presented in Figure 7-1.

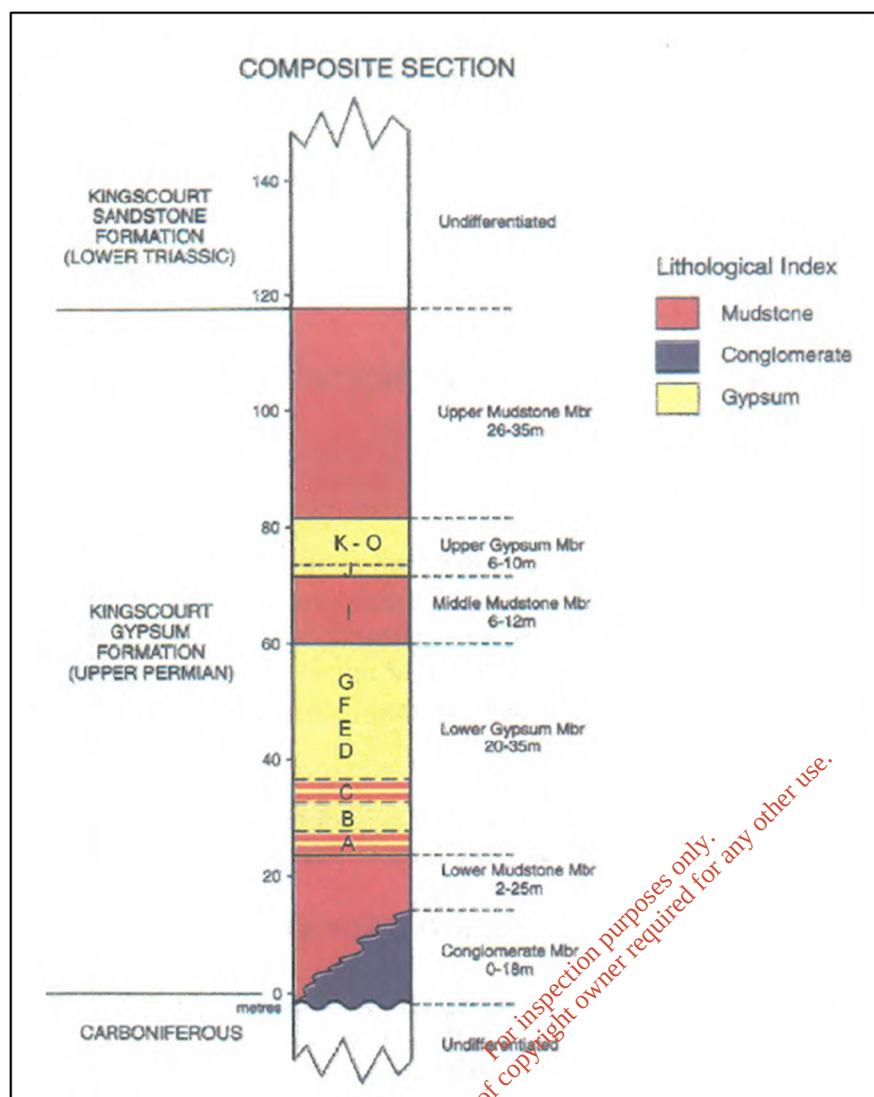


Figure 7-1 Typical Stratigraphic Column of the area (Gardiner and McArdle 1992)

Topography and Landslides

The local surrounding land to the mine is located 43 m Ordnance Datum (OD), with a steep decrease in elevation towards the mine excavation. The surrounding land generally slopes to the south, southeast towards the coast and Irish Sea with a localised high point to the west near Cornasaus and Bailieborough.

No landslide events have been recorded in the area. Landslide susceptibility is classified as low (inferred) with a localised moderately low to moderately high area in the north of the mine site.

It is noted that following the unexpected water ingress into Drummond Mine on the 22nd June 2018, a subsidence occurred at the Drumgoosat Mine on the 23rd September 2018.

7.3.1.4 Land Use

The Corine 2019 mapped land cover on the EPA website indicates the site area is classified as a mineral extraction site, with that the majority of the land surrounding the site classified as 'pastures'. Mixed forest areas are noted to the northeast and southwest representing Lough Fea and Dun Na Ri Forest park respectively. No additional land uses of interest were noted within a 1 km radius of the site.

Low density residential houses are present surrounding the site, with the closest residence located circa 170 m west. Top Oil fuel station is located on the northwest boundary of the site on the R179. The Magheracloone Mitchells GAA club is located 150 m north of the mine boundary; it is understood, that the GAA club is proposed to be moved from its current location.

7.3.1.4.1 Licenced Facilities

One EPA Industrial Emissions (IE) licence for the site, P0519 is established. The licence covers the operations and emissions from the mine and factory site. The licence P0519-01, issued by the EPA in 2002 was amended in 2005 to P0519-02 and to the current licence P0519-03 in 2015.

Seven licensed facilities (P0866, P0806, P0065, P0528, P0037, P0371 and P0842) and one waste facility (W0195) are located within a 10 km radius of the mine site. These include treatments or processes for the purposes of the production of food products from animal raw materials, building products, the manufacture of coarse ceramics, the rendering of animal by-products and, the recovery or disposal of waste and the dyeing, treatment or finishing of textiles. These facilities do not appear to be Seveso facilities.

One EPA licensed facility (P0866-01) is within a 1 km radius of the site. The registered licensed activity, P0866-01 is for the rearing of poultry in installations where the capacity exceeds 40,000 places. The site does not have emissions to water or onsite disposal of materials / waste as part of its licence.

Three licenced sites were noted to discharge to the same waterways utilised by the mine or factory site, as follows:

- Breedon Brick Limited (P0528), located 3.6 km south of the mine site. The site is licenced to manufacture ceramics including refractory bricks, stoneware pipes, facing and floor brick and roof tiles. The site contains one emission point to water (W1-1) which discharges from the sedimentation lagoon in the northern corner of the quarry site to the River Lagan (Glyde_030). This water joins the mine and factory site water at the River Lagan intersection circa 2 km north of the site and then the remaining of the water at the confluence point below Rahans Lough
- Lissaden Towels Limited (P0371) historically discharged water through an emission point E 1, into the River Glyde (Glyde_040) 7 km south east of the mine site. This license was surrendered in August 2005. It has not been considered further in this assessment, and
- Kingspan Building Products Limited (P0065) licensed for the production of organic chemicals, such as plastic materials (polymers, synthetic fibres and cellulose-based fibres). The site has no emissions to water or onsite disposal of materials.

7.3.1.4.2 National Parks and Wildlife Services (NPWS)

A review of the NPWS database (04.08.2020) did not identify any designated areas of conservation (Natural Heritage, Areas of Conservation, Special Protected Areas) within a 10 km radius of the site. Eight proposed Natural Heritage Areas (pNHA) are located within a 10 km radius of the mine site (site codes: 00560, 002077, 00561, 001599, 001671, 001608, 001594 and 001828).

7.3.1.4.3 Geological Heritage

The mine site is recognised as a locally important geological site. The GSI online database states it is a 'large open-cast gypsum mine with numerous intersections of old underground mine workings. It is considered an economic deposit of considerable importance and probably the largest pit in the country'. It is further recognised in the Monaghan County Council 2019 – 2025 development plans 5 policy objectives (GEP 1 to GEP 5) under their County Geological Sites Policy.

7.3.2 Existing Environment & Baseline Information -The Factory Site

7.3.2.1 Site History

The factory site is located south of the town of Kingscourt, across the Cavan County border in County Meath. The site is located in a low lying valley on the eastern edge of the R162. The factory site consists of onsite buildings and hardstanding to the west and a historical onsite landfill to the east of the site, a historical railway line running in a north-south alignment is present on the western landfill boundary. The surrounding landscape is predominantly pastoral fields with associated low density residential housing.

A review of historical maps online suggests the factory site was agricultural land in 1837 – 1842 with three buildings, sheds, present in the north eastern corner of the site. A 'water spout' was mapped in the south-central portion of the site with the area currently occupied by the landfill was vacant land. In 1888-1913 the land appeared to be mostly cleared and the 'water spout' and onsite buildings removed, one small building was constructed in the south of the site. The railway line transecting the current landfill is present with a pipeline or roadway leading from an onsite building.

The Applicant noted some operations were in the area in the late 19th century, the modern-day operation on the factory site commenced in 1936. A review of aerial photographs confirms the operational site layout in 1995 with potential evidence of landfilling operations to the west of the site from this period onwards. The layout and construction of the main building appears similar to current day conditions. Land clearing is noted to the north and west of the site, potentially associated with historical lagoons or storage areas, these areas are filled in by the year 2000. A review of historical photographs did not identify significant onsite land changes between 2000 and current day with the exception of the capping of the landfill and upgraded surface water management system, detailed further in 7.3.2.3

7.3.2.2 Site Infrastructure

The factory site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite.

As part of the licence requirements the factory site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three-year basis with frequent visual inspections. A review of the 2019 Annual Environmental Report (AER) suggested all bunds and containment systems were in acceptable condition at the time.

Additionally, the site contains an onsite waste water treatment plant, a Hydro International Biological Treatment System Waste Water Treatment Plant (WWTP) installed in 2006. Septic effluent from the production plant is treated through physical and biological treatment prior to discharge to a percolation area. The WWTP contain a balance tank / pumping station, sequencing batch reactor tank, sludge holding tank and clear water tank.

Detailed information regarding materials assets on the site is provided in Chapter 14. Material Assets.

7.3.2.3 Onsite Landfill

The factory site historically operated a landfill facility utilised for the disposal of wastes arising from the plasterboard manufacturing process. The landfilling practice was active until July 2009 and operated under a waste management plan in compliance with IE licence P0519-03. It is unclear when landfilling commenced onsite, based on a review of aerial photographs it is considered circa 1995.

The landfill consists primarily of waste gypsum plasterboard that was deemed unfit for further processing or sale. The gypsum was deposited in a shredded form or layered in boards, at the time of closure in 2009 the waste stream within the landfill was estimated to be 95% plasterboard and 5% gypsum residue including wet waste, dry edging waste and dry waste. A small percentage of general waste arising from the facility was also disposed of within the landfill, a practice which ceased circa 2003 with the implementation of the waste management plan at the facility.

The landfill is positioned to the east of the factory site with the eastern edge of the landfill bounded by the eastern slope of the valley. West of the landfill is a disused railway with the main processing facility beyond. Agricultural land is present to the north, east and south with associated low-density residential housing. The landfill extends approximately 12 m above ground level and included a topsoil berm containing a small volume of gypsum waste at the western boundary near the railway line.

RPS were engaged in 2018 to update the landfill Closure, Restoration and Aftercare Management Plan (CRAMP), originally prepared in July 2009, in accordance with section 10.3 the EPA licence P0519-03. The updated CRAMP details activities which have been undertaken since the closure of the landfill in accordance with the EPA landfill site design manual and best practice including capping of the landfill. The landfill capping construction works commenced in July 2017 and were completed in May 2018 by Wills Bros Ltd. The capping system includes a fully lined LLDPE impermeable liner, gas and surface water geocomposite and one metre of subsoil and topsoil. An aftercare period of 30 years was considered.

The key sensitive receptors identified were surface water, groundwater, human beings, air quality and natural habitats and protected species.

All surface water runoff from the capped landfill is directed through water filter or stone filled drains to the Ballynaclose River (Glyde_010) north of the landfill. This river contains surface water monitoring points as part of the EPA licensed monitoring points.

Groundwater is protected through a leachate management system which was upgraded with the capping in 2017 / 2018. A leachate interceptor drain is present around the entire perimeter of the landfill draining to the leachate lagoons immediately north of the landfill. Leachate is treated by aeration and settlement. The risk to groundwater

from the landfill is considered low based on the relatively low permeability geological setting, high naturally occurring concentrations of sulphate, calcium and manganese and the recently installed landfill cap.

Four surface water / leachate lagoons are present capturing surface water runoff from the factory, leachate from the landfill and surface water runoff from the western portion of the landfill. All lagoons are believed to be underlain by natural clay with the exception of lagoon No.3 which is lined. Elevated ammonia and sulphate have been recorded in shallow groundwater adjacent to the lagoons but is not reflected in downgradient sampling locations. Leachate is treated by aeration and settlement from the north western edge of the landfill (in its most concentrated form) and sequentially through lagoons 1, 2 and 3 during which time suspended materials settle out. Water is pumped from lagoon 3 to 4. Surface water from the west of the landfill can also be diverted straight into Lagoon 4 as required. Water from the settlement lagoons is reused in the plasterboard manufacture process.

Routine environmental monitoring of the landfill is undertaken as part of the aftercare programme including surface water, biological assessment, groundwater level and composition, leachate level and composition and landfill gas. AECOM is not aware of any soil monitoring requirements.

7.3.2.4 Geology

Data and information relating to the geology of the mine site was derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the client. Additional data were obtained from the websites listed in Section 7.2.1.

Overburden Geology / Teagasc soils

According to the EPA mapping tool the Teagasc soils within the factory site consist of made ground with surrounding land described as deep well drained mineral soils, shallow well drained mineral soils and cutover / cutaway peat. The Quaternary subsoils are described as till and gravels derived from lower Palaeozoic sandstones and shales, gravels derived from lower Palaeozoic sandstones and shales and cutover raised peat.

The landfill area to the east of the site comprises of 95% plasterboard and 5% gypsum residue and a small percentage of general waste. It is capped with a fully lined LDPE impermeable line and one meter of subsoil and topsoil.

The annual groundwater monitoring report (Minerex 2020) states, historical Bord Na Mona drilling at the factory site, reported glacial tills between 3 m to 13 m in thickness across the site while the area around the landfill contained sands and gravels between 4.5 m and 11.5 m thickness.

Bedrock Geology

Data relating to the geology and hydrogeology of the site was derived from the online GSI Spatial Resource Viewer.

Three bedrock geological units are identified in the vicinity of the site, as follows:

- Clontail Formation, consisting of green-grey medium to thickly bedded coarse and very fine grained Tae greywacks, with dark grey, thinly bedded, poorly graded, quartzose fine sandstone and siltstone
- Kingscourt Gypsum Formation, consisting of mudstone with gypsum and anhydrite units, containing six members of basal conglomerate member (up to 18 m thick), a lower mudstone, a lower gypsum, a middle mudstone, an upper gypsum (6 – 10 m) and a final upper mudstone unit, and
- Westphalian (undifferentiated) Formation, consisting of grey to black shale and carbonaceous or pyritous, thin bedded siltstones and fine grained sandstones. Thin beds of coal may be present.

The factory site is underlain by the Kingscourt Gypsum Formation, which overlies the Westphalian rocks unconformably. The Kingscourt Gypsum Formation is faulted against the Clontail Formation by the Kingscourt Fault which lines the main road to the front of the facility in a north-south orientation.

Topography and Landslides

The factory site is located between 70 and 80 m Ordnance Datum (OD). The factory site is generally flat except for the constructed landfill to the east of the factory site. Regionally the site is located within a valley with the surrounding topography to the east and west up to elevations of 150 m OD. No landslide events have been recorded in the area with the area classified as low landslide susceptibility.

7.3.2.4.1 Land Use

The Corine 2019 mapped land cover on the EPA website indicates the factory site is classified as 'artificial surface' described as mine, dumps and construction sites. The surrounding area is primarily classified as 'agricultural areas' described as pastures.

Low density residential house are present surrounding the site, with the closest residence located directly west of the factory site, the nearest residential house to the landfill is located 100 m east of the landfill.

7.3.2.4.1.1 Licenced Facilities

Six licensed facilities (P0612, P0640, P0037, P0528, P0065, P0866) are located within a 10 km radius of the factory site.

No licensed facilities located on surface water ways associated with the mine or factory site were identified additional to those outlined in Section 7.3.1.4 Licenced Facilities.

7.3.2.4.1.2 National Parks and Wildlife Services (NPWS)

A review of the NPWS database (04.08.2020) did not identify any designated areas of conservation (Natural Heritage, Special Areas of Conservation, Special Protected Areas) within a 10 km radius of the site. Four proposed Natural Heritage Areas (pNHA) are within a 10 km radius of the site (Site codes: 001558, 001594, 00552 and 001828).

7.3.2.4.1.3 Geological Heritage

The factory site not within a geological heritage area.

7.3.3 Potential Source of Contamination

The EIAR has not identified any significant potential sources of contamination to land or soils as part of the Proposed License Amendment to allow for the increased concentrations of sulphate and electrical conductivity at discharged emission point Compliance Point CP-1.

7.3.4 Sensitive Receptors

For the purpose of this assessment the following sensitive receptors have been identified:

- Mine and factory site soils and bedrock.
- Offsite soils in neighbouring land uses, and
- Soils and sediments below the surface water receptors.

7.4 Assessment of Potential Impacts / Comments on Monitoring Results

This Environmental Impact Assessment Report relates to the potential significant effects of the Proposed Licence Amendment to the site's current IEL No. P0519-03. This is to allow for an increase from a limit of 200 mg/L to 1,250 mg/L for sulphate and an increase from 1000 µS/cm to 2,360 µS/cm for electrical conductivity in the River Bursk at Compliance Point CP-1.

The change to the licence relates to an increase in permitted sulphate discharge and electrical conductivity at an existing compliance point at the mine site utilising existing equipment. It will not require additional land take or construction which could potentially impact land and soils within the mine site or factory site.

Additionally, the requested increase in the permitted sulphate and discharge electrical conductivity is not considered to alter the land and soils within the 1 km of the mine and factory site.

7.5 Mitigation Measures

The change to the licence relates to an increase in permitted sulphate and electrical conductivity discharge at an existing compliance point utilising existing equipment. It has been assessed that this is unlikely to affect the use or condition of soil or land assets which could potentially impact sensitive receptors.

Given these conditions, no mitigation measures are required regarding land and soil at the mine site or factory site in relation to the licence amendment considered.

7.6 Cumulative Impacts

There are no identified cumulative impacts associated with the mine or factory site in relation to the Proposed Licence Amendment considered.

7.7 Residual Impacts

There are no identified residual impacts associated with the mine or factory site in relation to the Proposed Licence Amendment considered.

7.8 Summary

The Environmental Impact Assessment Report relates to the potential significant effects of a Licence Amendment to the site's current IEL No. P0519-03.

The Proposed Licence Amendment relates to a change in the ELV for Sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site only. The Proposed Licence Amendment will not require any additional infrastructure to be built or any existing infrastructure to be updated. The Proposed Licence Amendment does intend to alter any landscape related requirements as outlined within IEL P0519-03 and will not introduce any additional physical changes to the factory or mine site. It has been determined that a detailed land and soil assessment is not required and as such an assessment of potential impacts on land and soil has not been included with this chapter.

The outcome of the assessment indicated that there are no potential significant effects from the Proposed Licence Amendment and no potential for cumulative impacts were identified. No requirement for further mitigation was identified by the assessment.

8 Hydrology and Hydrogeology

8.1 Introduction

This Chapter of the EIAR assesses the potential hydrology and hydrogeology impacts and effects of the Proposed Licence Amendment. Where appropriate it provides details of proportionate mitigation. Essentially, the assessment considers the potential for non-conformance with the EU Water Framework Directive (WFD) (Directive 2000/60/EC) objectives including:

- “The need for the avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation”; and
- “The selection of appropriate means of preventing any significant predicted impact is made through modification of the drainage design, choice of discharge location(s) and / or adoption of runoff treatment methods, with the objective of designing-out potential adverse environmental impacts”.

It describes potential surface water and groundwater issues associated with the proposed increased EPA emission limit value (ELV) for sulphate (from 200 mg/L to 1,250 mg/L) and electrical conductivity (from 1,000 μ S/cm to 2,360 μ S/cm) at a Compliance Point CP-1, required due to a change in the water management system for the mine site. The site location and surface water pathways are present in Volume 3, Appendix A.8.1, Figure A8-1 and Figure A8-2.

This chapter should be read in conjunction with Chapter 6 Biodiversity and Chapter 7 Land and Soils.

8.2 Methodology

This assessment meets the requirements for an EIAR as outlined in the relevant EU legislation (Directive 2014/52/EU). This chapter has been prepared in general accordance with the EPA Draft guidance document ‘Guidelines on the Information to be contained in Environmental Impact Assessment Reports, 2017 (EPA, 2017).’, EPA guidance documents ‘Guidelines on the Information to be contained in Environmental Impact Statements, 2002 (EPA, 2002), ‘Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, 2003 (EPA, 2003).

8.2.1 Sources of Information

In order to gather hydrological and hydrogeological baseline information for the study area and to identify the environmental sensitivity and setting of the application site, a desktop study has been undertaken by AECOM which included the following sources of information:

- Ordnance Survey of Ireland (OSI) website¹⁷ for historical maps of 1:2,500 scale and 1:10,560 scale (1837 to 1913) and aerial photographs (1995, 2000, 2005)
- Geological Survey of Ireland (GSI) ‘Spatial Resources Viewer’¹⁸
- EPA Map Viewer¹⁹ for ground and groundwater information, as well as EPA Integrated Pollution Control (IPC) licenced facilities or EPA licenced waste facilities
- Office of Public Works (OPW) website, CFRAM website²⁰ and Flood Info website²¹ for flood data
- National Parks Wildlife Service website Map Viewer²²;
- EPA Catchments Map²³, and

¹⁷ [Ordnance Survey of Ireland](#) accessed 5 August 2020

¹⁸ [GSI Spatial Resources Viewer](#) accessed 5 August 2020

¹⁹ [EPA Map viewer](#) accessed 5 August 2020

²⁰ [CFRAM](#) accessed 5 August 2020

²¹ [Flood Maps - Floodinfo.ie](#) accessed 5 August 2020

²² [NPWS Map Viewer](#) accessed 5 August 2020

²³ [EPA Catchments](#), accessed 5 August 2020.

- Teagasc Irish Soils Information System²⁴.

In addition to the above information AECOM reviewed the following Applicant supplied information:

- EPA Industrial Emissions (IE) Licence, P0519-03
- Drummond Mine, Water Management Plan (WMP) (2019 to 2020), SLR, April 2019, Rev04
- Hydrogeology Study of Knocknacran Open Cast and Drumgoosat and Drummond Underground Mines, PITEAU Associates, February 2020
- Groundwater risk screening report 1632-2057 (Rev 0) Minerex Environmental, October 2017
- Laboratory tested surface water monitoring from October 2018 to January 2020 for the mine site
- Continuous river water monitoring results at Monitoring Point B, MSE-1 and Compliance Point CP-1 in 2019 for the mine site, and
- Laboratory tested surface water monitoring from 2017 – 2020 for the factory site licence monitoring points.

8.2.2 Legislation and guidance

The following relevant policy and legislation has informed the scope for the impact assessment:

Table 8-1 Legislation, Policy and Guidance

Legislative Guidance	Policy and
European Union Water Framework Directive (WFD) (2000/60/EC)	This was adopted as a single piece of legislation covering rivers, lakes, groundwater, transitional (estuarine) and coastal waters. The following legislation in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programmes in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments: • European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003); • European Communities Environmental Objectives (Surface Water) Regulations, 2009 (S.I. No. 272 of 2009 as amended); • European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010); • European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2016 (S.I. No. 366 of 2016); • European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010); • European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011); and • European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014).
Guidelines for Drinking-Water Quality, 4 th Edition, World Health Organisation 2017	Provides drinking water quality standards.
EPA, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (2003)	Interim Guideline values (IGVs) were developed by the EPA using a number of water quality guidelines in use in Ireland, including existing national environmental quality standards, proposed common indicators for the groundwater directive, drinking water standards and GSI trigger values.
EPA, Draft guidance document 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017)	An update to earlier guidance: • EPA, Guidelines on the Information to be Contained in Environmental Impact Statements (2002); and • EPA, Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2003).
Institute of Geologists of Ireland (IGI), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013)	Provides topic-specific guidance on preparation of this technical chapter.

²⁴ [Teagasc Irish Soils Information System](#) accessed 5 August 2020

8.2.3 Appraisals Methodology

The appraisal methodology considered a description of the impact i.e. the “quality” of the effects (i.e. whether it is adverse or beneficial), the “significance” of the effects (i.e. the magnitude of the effect in terms of the environment), the “probability” of the event occurring, and the “duration” of the effects (i.e. whether it is short or long term) and also considers the significance / sensitivity of the existing environment. Terminology for describing the quality, significance, extent, probability and duration of effects is set out in Section 3.7.3 of the 2017 EPA EIAR guidance (EPA 2017).

A qualitative approach was used in this evaluation and Figure 8-1 taken from the EPA EIAR guidance shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the effect.

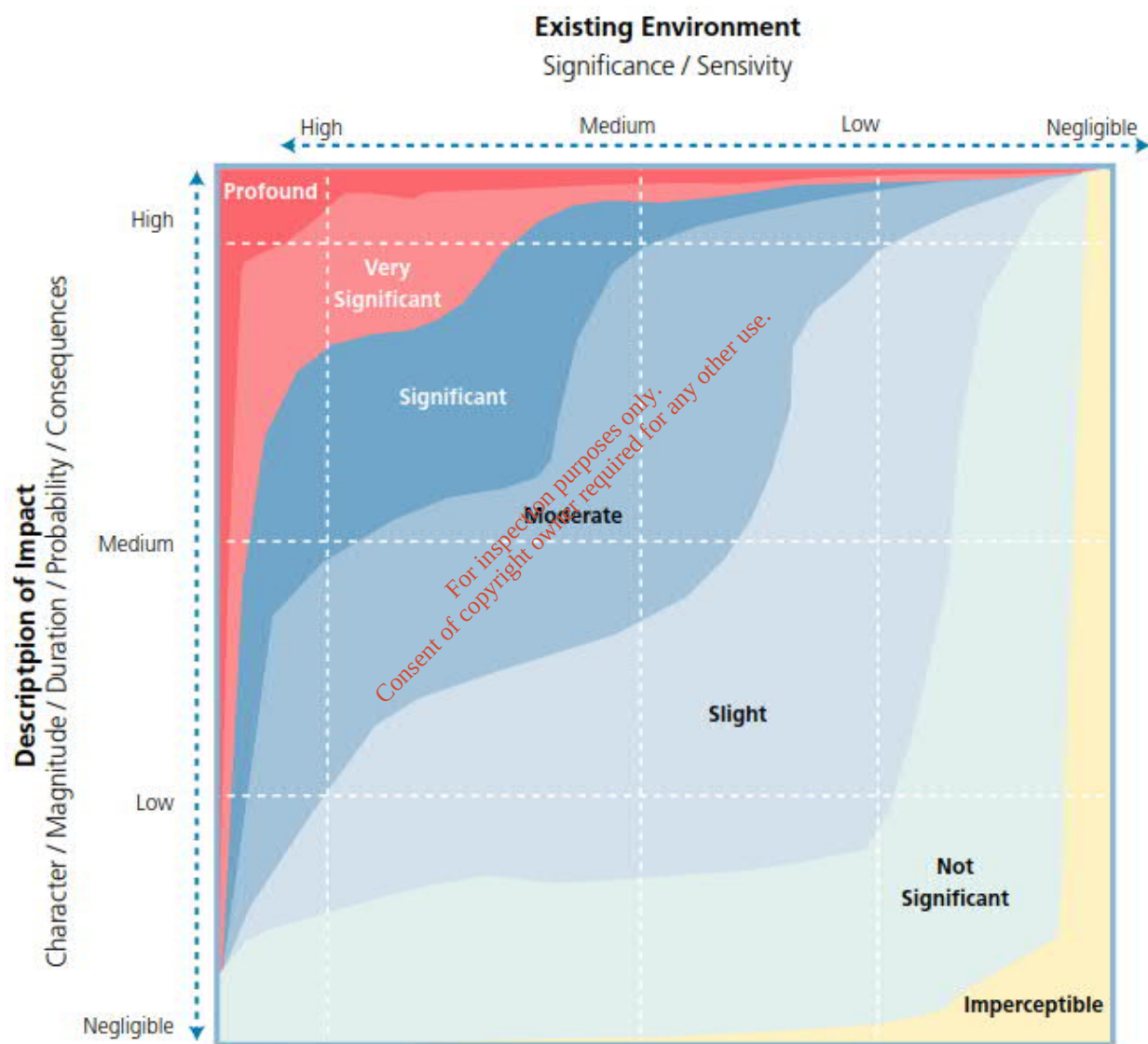


Figure 8-1 Determination of the Significance of the Effect²⁵

²⁵ Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports

Table 8-2 Describing the Significance of Effects

Significance Level	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound Effects	An effect which obliterates sensitive characteristics

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

8.2.4 Limitations in the Methodology and Gaps in Information

No significant data gaps or limitations were encountered as part of this assessment.

8.3 Description of Existing Environment Mine Site

8.3.1 Site History

Gypsum deposited within the Kingscourt formation has been subject to extensive historical mining in the region. The open pit mining operations commenced in the south-eastern portion of the site in 1989 prior to extending to the north and northeast of the site near the boundary of the R179 by 2000. In 2017, planning permission was granted by Monaghan County Council (Planning permit, 17217) to continue extraction of gypsum deposits from the open pit mine over an area of 54.86 hectares including progressive restoration and associated site works. It currently is ca. 70 m deep (lowest floor elevation about - 3 maODM) and has an extent of ca. 1,110 m × 500 m (55 ha).

Drumgoosat underground mine is located in the northern portion of the mine and was operational between 1963 and 1989. It is up to 100 mbgl depth and has an extent of ca. 1,700 m × 800 m (80 ha).

To supplement resources and recovery of gypsum, planning permission was granted in 2004 by Monahan County Council (Planning permit, 07430) for extraction of gypsum from underground (referred to as Drummond mine) and commenced full production in 2006. The Drummond mine has been operational from 2006 to 2008, and from 2013 onwards. It extends to about 155 mbgl depth and currently has an extent of ca. 1,300 m × 300 m (38 ha)..

In addition to the three mines within the main area of study, there are two historic underground mines located to the south of the existing Drummond mine. The Cormey mine was worked between 1952 and 1961. Further to the south, the Drumgill mine was worked in the middle part of last century.

Activities at the mine and factory site have been operated under an Integrated Pollution Control (IPC) licence (now Industrial Emissions licence), P0519, since 2002. A revised licence was issued in 2005 (P0519-02) and in 2015 (P0519-03).

8.3.2 Surface Water Drainage

As part of the Water Management Plan for the mine, the decommissioned Drumgoosat underground mine was utilised to store mine water to manage discharge to the River Bursk. This storage system allowed the mine to temporarily store the groundwater until suitable flow conditions for release occurred. The discharge of mine water was automatically adjusted depending on the available flow and assimilative capacity in the river to ensure that emission limit values set-out in the licence were not exceeded.

However, following the unexpected water ingress into Drummond Mine on the 22nd June 2018, when a fracture was intercepted by the mining operations, and the Drumgoosat Mine subsidence which occurred on the 23rd September 2018, it was decided to no longer store water in Drumgoosat Mine. All site mine water has been discharged directly off site, without prior storage, to the existing discharge point on the River Bursk. Water discharged from the mine is natural groundwater and rainwater which has come into contact with the gypsum associated minerals underground. The discharge water does not include any process water or effluent from onsite operations. Prior to discharge the water is allowed settle in dedicated lagoons.

In the current arrangement the system operates as follows:

- Groundwater inflow to Drummond Mine is conveyed to a central sump in the mine and then diverted through pumping to the settlement lagoons, referred to as the "southeast lagoons". A bulkhead was installed following the inflow that occurred in June 2018. Water from here is also routed to the central sump.
- Water from Drumgoosat Mine is pumped from a borehole in the old mine workings up to the southeast lagoons.
- Where surface water occurs at the Knocknacran Mine it is directed towards the base of the open pit mine and transferred to water settlement lagoons (Golder Associates, 2020).
- Run off from around the workshop area is directed to a hydrocarbon separator prior to pumping into the southeast lagoons.

Water from the lagoons is discharged through the licensed discharge point, MSE-1, and monitored down gradient through the IE licence compliance and monitoring points. Flow rate discharge records for the period January 2017 to August 2020 have been reviewed and summarised in the table below. It is noted that a limit of 510m³/h (or 12,240 m³/day).

Table 8-3 Average Daily Flow

Year	Annual Rainfall	Annual Average	Maximum	Minimum
2017	887.4 mm	1,680 m ³ /day	12,240 m ³ /day	0 m ³ /day
2018	872.1 mm	2,664 m ³ /day	9,480 m ³ /day	0 m ³ /day
2019*	1,145.3 mm	4,464 m ³ /day	10,128 m ³ /day	912 m ³ /day
2020*#	486 mm	3,895 m ³ /day	8,337 m ³ /day	180 m ³ /day

* Revised Water Management Strategy implemented.

Note: data from 2020 only covers 8 months (Jan-Aug)

PITEAU (2020) have estimated the relative contribution of the mining operations to the water discharge from the site. The table below summarises the findings.

Table 8-4 Estimated average daily flow from mining operations

Source	Flow Rate	Comments
Drummond Mine	2,000 m ³ /day	Historical inflows were between 1,400 and 2,200 m ³ /d. Current inflows are a little over 2,000 m ³ /d, with about 50% of this derived from the 2018 mine fault zone. Inflows from the fault were initially estimated to be around 12,000 m ³ /d but reduced quickly, and have since reduced to around 1,200 m ³ /d.
Knocknacran Open Cast	10 m ³ /day to 950 m ³ /day	This is mostly surface water run-off and significantly influenced by rainfall.
Drumgoosat Mine	20 m ³ /day to 870 m ³ /day	The seasonal nature of the pumping records suggests that much of the water would likely have been derived from surface infiltration, potentially focused on natural or mining-induced surface depressions

Source: PITEAU, 2020

Rainfall data collected from the Kingscourt Gypsum Station (met.ie) would indicate that a reasonable correlation exists between annual rainfall and the volume being discharged from MSE-1 which is consistent with PITEAU's assessment.

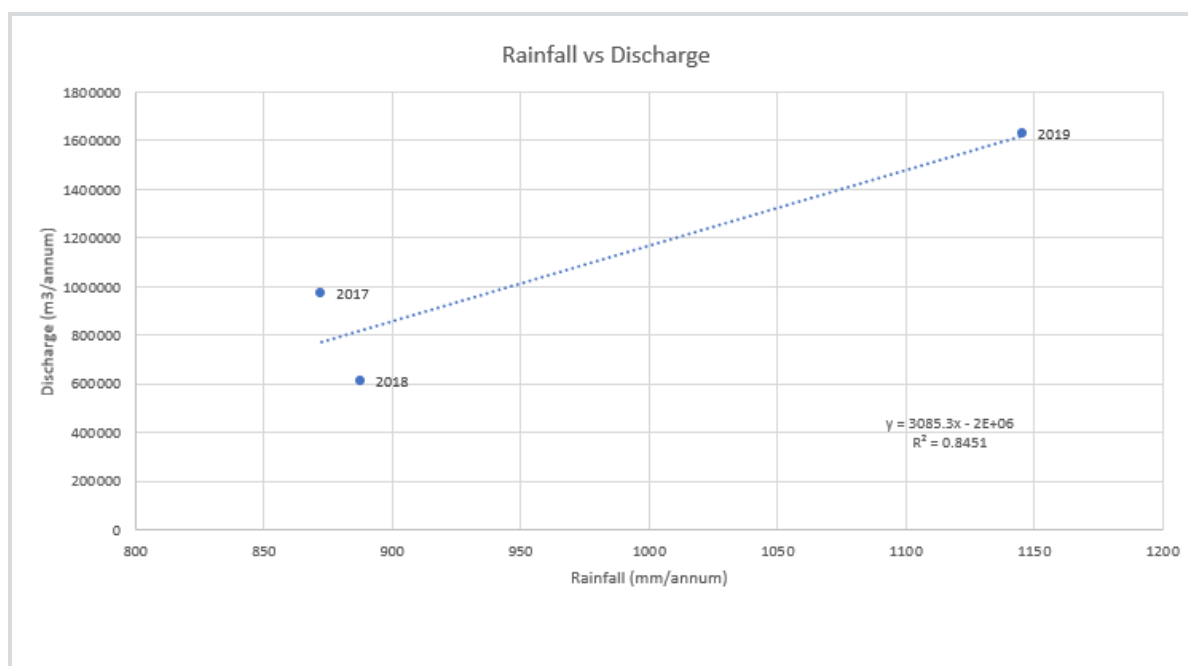


Figure 8-2 Discharge volume in relation to rainfall (source: met.ie Kingscourt Gypsum Station [Accessed 23/09/2020])

The mine site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite to avoid potential water contamination. As part of the licence requirements the mine site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three-year basis with frequent visual inspections. A review of the 2019 Annual Environmental Report (AER) indicated all bunds and containment systems were in acceptable condition at the time.

8.3.3 Geology / Hydrogeology

Data and information relating to the geology / hydrogeology of the site were derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the Applicant.

8.3.3.1 Overburden Geology

According to the EPA mapping tool the subsoils in the areas surrounding the mine consists of made ground and till derived from lower Palaeozoic sandstones and shale. The thickness of the overburden in the general area ranges from 1 m to 50 m with an average overburden thickness is 13 m (PITEAU, 2020). The overburden and till has been stripped from the site surface area to allow for the open pit mining operations. These deposits are being used during the ongoing phased restoration of the mine site.

8.3.3.2 Bedrock Geology and Aquifers

According to the GSI, the principal bedrock aquifer units in the area are (Figure 8-3):

- Kingscourt Sandstone Formation – Permo-Triassic sandstones to the west of the site which are locally important aquifers ("bedrock which is generally moderately productive")
- Namurian sandstones and Carrickleck Sandstone Member – Namurian sandstones to the east of the site have also been classified as a locally important aquifer
- Milverton Group – Dinantian pure bedded limestones east of the Namurian sandstones are considered to be a regionally important karstified aquifer, and
- The Kingscourt Gypsum Formation (central to the site) and the Westphalian Shales to the north are both considered poor aquifers. The GSI describes these as "bedrock which is generally unproductive except for local zones".

The groundwater abstracted as part of the mining operations is considered primarily from the Louth groundwater body. Nearby groundwater bodies include the Kingscourt and Carrickmacross basins.

The groundwater vulnerability within the mine area is classified as extremely vulnerable (as a result of the open pit operations) with the rock at or near surface. Surrounding groundwater vulnerability ranges from moderate to low.

A summary of the groundwater body conditions is presented in Table 8-5.

Table 8-5 Groundwater Body

Groundwater Body	Description	Distance from site	2013 – 2018 Status	Trends / Charts 2007 - 2018	Risk
Louth IEGBNI_NB_G_019	Poorly productive bedrock	0 m	Good	Upwards trend Ammonia – Total (as N), Chloride, Conductivity and Orth-Phosphate (as p) Downwards trend Nitrate (as NO3)	Review
Kingscourt IE_NB_G_017	Productive fissured bedrock	Directly east and west	Good	No data available	Not at risk
Carrickmacross IE_NB_G_016	Karstic	1.5 km east	Good	Upwards trend Ammonia – Total (as N), Chloride, conductivity and Orth-Phosphate (as p) Downwards trend Nitrate (as NO3)	Review

According to the GSI, the recharge within the of the mine footprint is in the order of 100 to 200 mm/yr, with lower recharge (<50 mm/yr) observed above Drummond underground. The western margin of the Kingscourt Sandstone Formation is associated with higher recharge: 350 to 550 mm/yr and locally greater than 600 mm/yr.

A comparative analysis of groundwater quality monitoring in the vicinity of the mine areas was carried out by PITEAU (2020). Values in the range of 1400 mg/L to 1900mg/L for sulphate and 500 mg/L to 600 mg/L of Calcium were observed locally in the bedrock lithology. This was interpreted as evidence of active gypsum dissolution processes and is deemed to be the source of sulphate in the mine effluent. Although this is based on a limited data set (2 values), it is noted that values recorded in the Drummond mine southern inflow are generally lower (545 mg/L for Sulphate).

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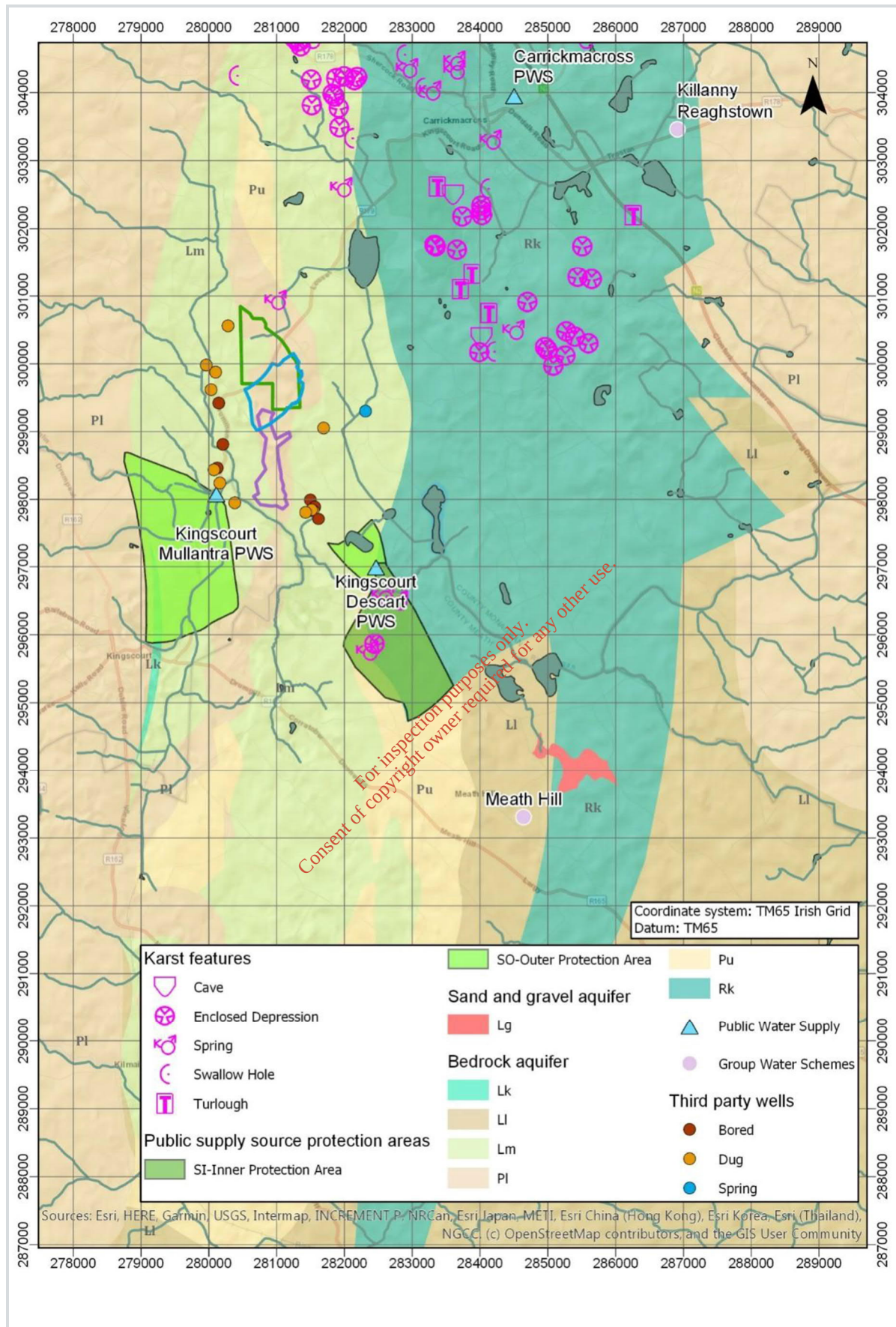


Figure 8-3 GSI bedrock aquifer units and groundwater supplies (PITEAU, 2020)

8.3.3.3 Depth to Groundwater and Flow

A review of the GSI online mapping database infers regional groundwater elevation is approximately 40 – 60 m OD. The regional groundwater flow is anticipated to be towards the east with the final discharge point the Irish Sea circa 28 km southeast from the mine site.

Groundwater level monitoring data have been compiled by Minerex and are available for a 38 year period (1981 and 2019). Data for the 29 wells with multiple years of data were analysed by PITEAU. Of these:

- No. 6 wells are in superficial deposits (till)
- No. 17 wells are in the Kingscourt Gypsum Formation, and
- No. 6 wells are in the Namurian Sandstone Formation, including the well drilled into the Drumgoosat underground workings to control water levels.

Due to the dewatering operations as part of the underground mining the groundwater level within the mine site and its immediate surroundings is significantly reduced. A detailed conceptual model was developed for the site (PITEAU, 2020) which shows that low groundwater elevation in the mine is considered to result in a cone of depression in the local area creating a preferential flow pathway for surrounding water towards the mine. Hence providing some level of protection to the local bedrock aquifer from contamination events that might occur at the mine site (Figure 8-4). It is noted that as a result of the geological setting the extent of the cone of depression is deemed to be limited (PITEAU, 2020) due to the presence of low permeability (vertical) discontinuities between geological units. The limited drawdown observed in the overburden wells is consistent with low permeability deposits observed in the area and indicates a low level of connectivity with the overburden.

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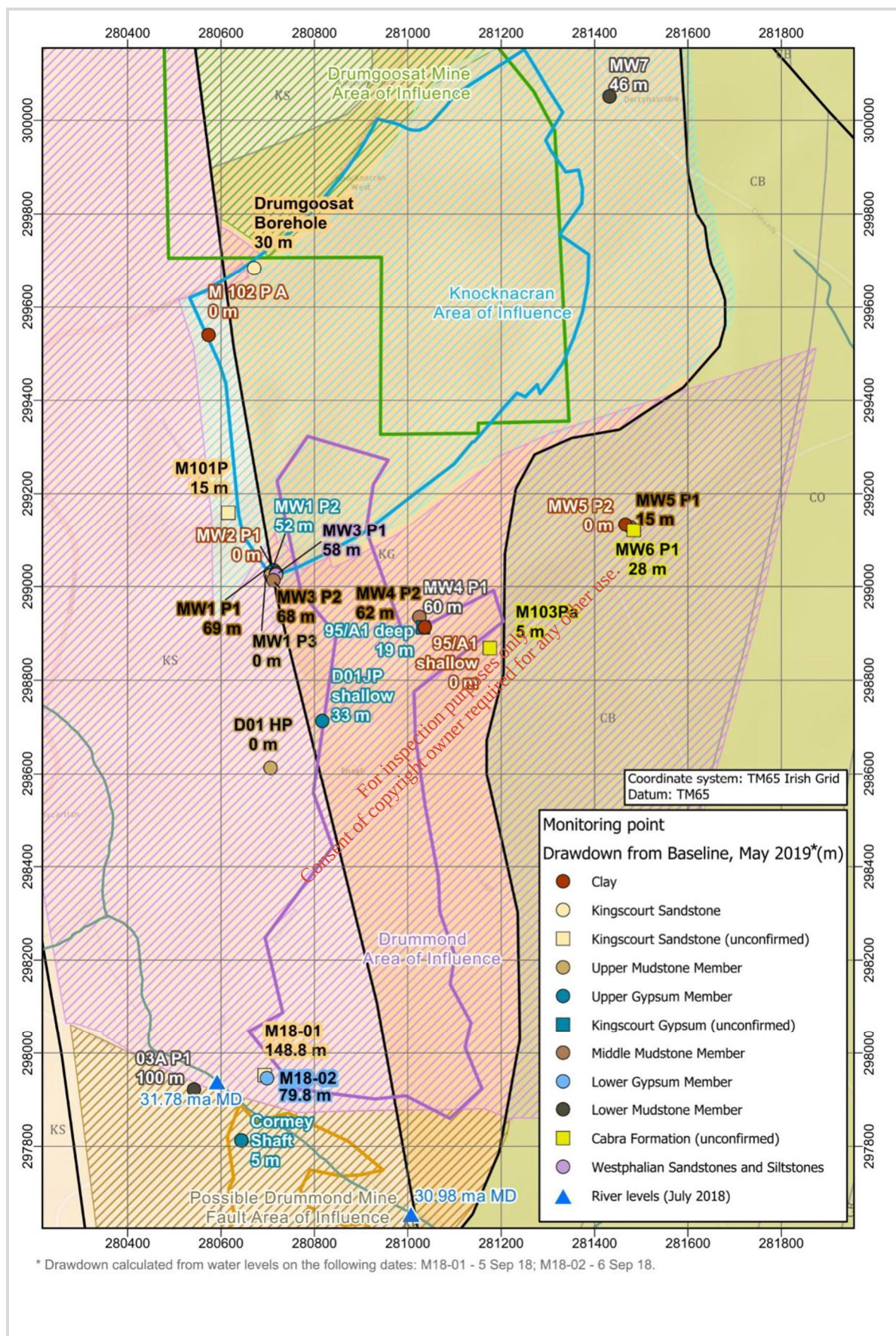


Figure 8-4 Interpreted monitoring well drawdown from baseline (PITEAU, 2020).

8.3.3.4 Wells and Groundwater Usage

The mine site contains 14 groundwater monitoring wells for periodic monitoring events in accordance with the EPA licence P0519-03.

A review of source protection zones (SPZ) within a 3 km radius of the site identified two key areas, associated with Public Water Supply (PWS) wells in the area. A summary of the findings is presented in Table 8-6. It is noted that according to the PITEAU report (2020) these PWS well are not in hydraulic connection with the mine site.

Table 8-6 Source Protection Zone

Source Protection Zone	Distance from Site	Active	Information
Kingscourt Mullantra PWS BW01	1.2 km southwest (upgradient)	Yes	Kings court public water supply is provided by BW01 (500 m ³ /day) and Ervey Lough (500 m ³ /day). Cavan County Council plan to phase out abstraction from Ervey Lough by 2013 and replace it with two additional borehole groundwater sources, outlined below. Localised groundwater flow is east towards the mine site.
Descart wells BW02 and BW03	2 km southeast (upgradient)	No	Two test wells established to replace abstraction from Ervey Lough BW02 and BW03. The wells are currently not listed as active, based on this it is considered public water supply is still sourced from BW01 and Ervey Lough.

AECOM undertook a search of the GSI database for known groundwater wells within a 3 km downgradient radius of the mine site. The registered wells, types and accuracy are presented on Volume 3, Appendix A.8.1 Figure A8-3, Appendix A.

Sixty-five, groundwater wells were noted downgradient of the mine site as follows:

- 10 domestic use only
- 8 agricultural & domestic use
- 1 industrial use
- 9 public supply (County Council) and
- 37 other / unknown.

Well depths ranged from 0.5 m and 351 m below ground level with yield generally classed as poor, with some areas moderate and the county council supply wells excellent.

The closest downgradient domestic use well (2629SEW178) is located circa 1.5 km south of the site. The well is drilled to 52.7 m bgl with a good yield of 327 m³ per day. An agricultural domestic well (2629SEW133) is located 1.4 km south of the mine site. The well is hand dug to 1.2 m; no yield information is available, due to the shallow nature of the bore is it considered unlikely it is used for extensive agricultural / domestic use.

The GSI database of wells is not complete as there is no legal requirement to register wells. Due to the rural nature of the mine site it is considered likely groundwater wells within the area are used for agricultural and domestic purposes.

8.3.4 Water Supply

The mine sites water supply is provided entirely by mains services. There are no known abstractions of surface water.

8.3.5 Hydrology

Data and information relating to the hydrological setting of the site were derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the Applicant.

8.3.5.1 Surface Water Courses

There are three primary local surface water courses near the mine site, as follows:

- Magheracloone Stream. Running north to south along the western boundary of the site.
- River Bursk (also known as River Lurgans). Running along the eastern boundary of the site and receiving water from MSW-1.
- River Lagan (also known as the River Glyde). Receives water from both the Magheracloone and Bursk and flows from west to east to the south of the site.

The mine site and aforementioned rivers fall within the Water Framework Directive (WFD) 06 - Newry, Fane, Glyde and Dee catchment and sub catchment 06_7 (Glyde_SC_010).

Glyde_SC_010 falls within two river sub basins, both of these currently receive site surface water, as follows:

- Glyde_020 (including Magheracloone Stream) is 27 km in length and located to the north and west of the mine site travelling generally in a south-southeast direction. Discharge water from MSW-1 flows through a ditch east along the site boundary before veering northeast approximately 200 m from the mine site, where it eventually joins the Glyde_020 (a portion of River Lagan) 680 m northwest of the mine site. It is noted that this discharge is planned to be discontinued. Glyde_SC_020 flows south from this point, before amalgamating with Glyde_010 and Glyde_030 1.1 km southwest of the site. The Glyde_020 river body is classed 'in review' up and downgradient of the mine site. Where it joins Glyde_030 downgradient of the mine site it is classed 'not at risk'. Routine biological, operation, supporting chemistry, investigative and chemical monitoring is undertaken within the river. The online EPA map viewer records the upstream monitoring point Q value Score of 4 – 5 and the downstream Q value Score of 4. The river water quality status 2013-2018 is listed as good. Glyde_020 is not classed as a drinking water river.
- Discharge water from MSE 1 flows through a culvert towards the south of the site and veers east to outfall on the Glyde_30 (including River Bursk) approximately 680 m from the mine site. The Glyde_30 is 57 km in length and located to the east of the mine site travelling in a south-southeast direction. The mine surface water discharge point enters this river as presented in Volume 3, Appendix A.8.1, Figure A8-1. Downstream of the discharge point the river (River Bursk) flows southeast adjoining Descart Lough and Rahans Lough. The river continues in a general south eastern direction prior to the eventual discharge to Irish Sea 28 km southeast of the site. The Glyde_30 river body is classed not at risk directly up and downgradient of the site. Routine biological and operation monitoring of the river body is undertaken. The online EPA map viewer recorded the nearest ecological monitoring point approximately 6 km downstream of the site, with a Q value Score of 4. The river water quality status 2013-2018 is listed as good. Glyde_030 is classed as a drinking water river (IE_NB_06GO20400), protected area code: IEPA1_NB_06GO20400.

The two river sub basins, mine site discharge water and factory site discharge water meet at a 'confluence point' south of Rahans Lough. The water systems, loughs and surface water flow is presented in Volume 3, Appendix A.8.1, Figure A8-1.

8.3.5.2 Surface Water Pressures

Agriculture negatively affects most of the at-risk waterbodies in the Newry-Fane-Glyde-Dee catchment (KD Environmental Ltd, 2019; EPA, 2018). Based on aerial imagery and the Corine 2018 land use values on the EPA maps website, a sizeable agricultural landscape surrounds the River Bursk and Lagan / Glyde, both upstream and downstream of the mine water discharge point in the River Bursk. Therefore, pollution from agricultural run-off, such as pesticides and nutrients (mainly nitrogen, phosphorus, and potassium), is deemed to impact these watercourses. Other pressures in the Glyde catchment include hydromorphological pressures, urban wastewater, industry, and forestry (EPA, 2018).

Two potential surface water abstractions points from nearby water systems were identified during the desktop review:

- Tallanstown pumping station, location approximately 18 km downgradient of the mine site on the River Glyde north of Tallanstown; and
- Ervey Lough water supply located approximately 5 km up / cross gradient from the mine site southwest of Kingscourt.

The proposed increase in sulphate concentrations is not considered to have a direct impact on the Ervey Lough as it is across gradient to the Glyde_30 river receiving the discharge water. It has therefore not been considered further in this assessment. The Tallanstown pumping station is located circa 18 km downgradient of the mine site discharge

point, as such is considered to potentially be impacted by the increase in sulphate concentrations onsite and is brought forwards in the assessment.

8.3.5.3 Offsite Emissions to Surface Water

A review of EPA Industrial Emission (IE) licences surrounding the mine site was undertaken in the Chapter 7 Land and Soils.

One licensed facility was identified to discharge water to the same waterways utilised by the mine site, Breedon Brick Limited (P0528), located 3.6 km south of the mine site. The site is licenced to manufacture ceramics including refractory bricks, stoneware pipes, facing and floor brick and roof tiles. The Breedon site refers to one emission point to water (W1-1) which discharges from the sedimentation lagoon in the northern corner of the quarry area to the River Lagan (Glyde_030). This water joins mine and factory site water at the River Lagan intersection circa 2 km north of the Breedon Brick Limited site and then the remaining of the water at the confluence point below Rahans Lough.

8.3.5.4 Site Emissions to Surface Water

Site water emissions comprise of groundwater inflow from the underground mining areas, direct rainfall water from the open pit mine and run-off water from the areas surrounding the mine site. Site run-off from around the workshop area is directed to a hydrocarbon separator prior to pumping into the settlement lagoons.

The site has four registered emission / monitoring points for water, presented in Volume 3, Appendix A.8.1, Figure A8-2 and detailed below. It is noted that MSW-1 is planned to be decommissioned in the near future.

Table 8-7 Emissions to Water

Name	Type	Location	Receiving water body	Required analysis
MSE-1	Emission Point 12,240 m ³ (daily max.) 510 m ³ (hourly max.)	Discharge from final holding tank 281489E 299140N	River Bursk Glyde_030	Continuous: Flow, conductivity, sulphate (empirical relationship with conductivity). Monthly: temperature, pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), sulphate, total ammonia, nitrate, molybdate reactive phosphorus (MRP), total phosphorus, manganese, mineral oil, chlorides. Four times a month: Suspended solids, settleable solids. Bi-annually: Copper, chromium, nickel, total heavy metals. Toxicity monitoring as required by agency.
CP-1	Compliance Point	70 m downstream of discharge to River Bursk 282041E 298746N	River Bursk Glyde_030	Continuous: Conductivity, sulphate (empirical relationship with conductivity). Monthly: Nitrate, suspended solids, sulphate, biochemical oxygen demand, ammonia, MRP, total phosphorus, heavy metals Barium has a limit value at CP-1 of 0.1 mg/L set within the EPA licence, however is not included within the EPA monitoring suite. Monitoring of Barium is currently being undertaken by the site on a monthly basis.
MSW-1	Emission Point	280582E 288637N	Magheraclone Stream Glyde_020	Weekly: Visual inspection. Quarterly: Temperature, pH, biochemical oxygen demand, calcium, sulphate, total phosphorus, total nitrogen, conductivity.
B	Monitoring Point	281991E 298912N	River Bursk (upstream of MSE-1) Glyde_030	Monthly: Conductivity, nitrate, suspended solids, sulphate Annually: Biochemical oxygen demand, ammonia, MRP, total phosphorus, heavy metals.

Limit values for emission parameters set out in EPA Licence P0519-03

8.3.5.5 Surface Water Monitoring

In line with the licence requirements outlined above and with the site WMP, routine surface water monitoring is undertaken by the mine site. Data from MSW-1 has not been presented in this assessment as it is to be decommissioned in the near future and is not to be impacted as part of the Proposed License Amendment.

A summary of the sampling points is presented in Table 8-8 and depicted in Volume 3, Appendix A.8.1 Figure A8-1.

Table 8-8 Monitoring Data

Sampling Point	Distance from point of discharge	Sulphate Monitoring	Monitoring Program
CP-1	0.07 km	Daily (calculation) and Monthly (analysis)	P0519-03
MSE-1	0.7 km (upstream)	Daily (calculation) and Monthly (analysis)	P0519-03
B	0.1 km (upstream)	Monthly	P0519-03
D4-SW1	2.2 km(upstream)	As required by WMP	Water Management Plan
D4-SW3	0.35 km(downstream)	As required by WMP	Water Management Plan
D4-SW5	1.7 km(downstream)	As required by WMP	Water Management Plan
D1-SW12	5.6 km(downstream of confluence point)	As required by WMP	Water Management Plan
D1-SW16	16 km (downstream of confluence point)	As required by WMP	Water Management Plan

AECOM reviewed the surface water monitoring laboratory data provided by the Client for the period January 2017 to December 2019. Except for sulphate and conductivity monthly water quality has been generally compliant with the limits set-out in the licence (MSE-1 and CP-1) for the period observed. From November 2018 onwards exceedances of sulphate and conductivity ELVs (200 mg/L and 1,000 µS/cm respectively) are noted regularly at CP-1 (9 out of 14 readings) with the highest recorded values of 591 mg/L for Sulphate and 1,423 µS/cm for Conductivity (July 2019). It is noted that due to the strong correlation between the two parameters, an exceedance for conductivity always corresponds to an exceedance for sulphate. However, the inverse is not true suggesting that the limit for sulphate is conservative with respect to conductivity. Sulphate will be therefore considered as an indicator for water quality in the assessment here presented.

It is noted that, since September 2018, the discharge is operated in accordance with the proposed revised water management strategy and therefore observed concentrations would be reflective of the resulting surface water quality should the proposed increased sulphate limit be granted. The following sources of data were reviewed in more detail:

- Laboratory reported surface water results from SW1 (D4), MSE-1, CP-1, D4 SW3, D4 SW5, D1 SW12, D1 SW16, from October 2018 to January 2020 at the mine site, and
- Continuous electrical conductivity surface water monitoring at monitoring points, MSE-1 (mine effluent), Monitoring Pt. B (100 m upstream of discharge point) and Compliance Point CP-1 (70 m downstream of discharge point) for 2019 at the mine site.

The above-mentioned monitoring points are depicted on Volume 3, Appendix A.8.1, Figure A8-1 and A8-2.

The continuous surface water monitoring data is noted to be in general accordance with the laboratory data and provides a good representation of the daily average concentrations. Sulphate concentrations are calculated from electrical conductivity results from an in-situ meter.

While continuous monitoring of sulphate through correlation with electrical conductivity is deemed to be reflective of general water quality, the laboratory provided results are considered the most reliable data. However, the latter are only available at the intervals set out in Table 8-8.

One outlier data point was identified within the laboratory reported data. The concentration of sulphate at Compliance Point CP-1 on 3/10/2018 was reported at 43 mg/L significantly below average concentrations. To normalise the data AECOM has utilised the continuous monitoring concentration of 530 mg/L.

8.3.5.6 Sulphate Concentrations Time

The graph illustrated in Graph 1, shows the laboratory reported sulphate concentrations at locations downstream of the discharge point including, Compliance Point CP-1 (210 data points), SW3 (29 data points), SW5 (66 data points), SW12 (194 data points), SW16 (194 data points) between October 2018 and January 2020 at the mine site. Of the available data, 142 exceedances of the 200 mg/L ELV were reported during the period observed. It is noted that a large volume of surface water samples was collected between October 2018 and December 2018 in response to the change in water management practices at the site. The majority of the exceedances occurred during this period. Following this event, 86 exceedances of 200 mg/L were recorded at Compliance Point CP-1.

However, a review of the data shows that exceedances are generally minor, with the average concentration of all the monitoring data reporting at 191 mg/L.

The graph illustrated in Graph 2, shows the continuous monitoring sulphate concentrations at upgradient (monitoring point B), effluent (MSE-1) and downgradient (CP-1) of the site. The concentration of sulphate at Compliance Point CP-1 exceeded the licence value of 200 mg/L in 156 of the 362 data points with the majority of exceedances in the summer months between May and September. The average upstream value for 2019 was 59 mg/L, two upstream values at monitoring point B, exceeded the licence value of 200 mg/L. The reduction of sulphate concentrations from MSE-1 (the effluent) to Compliance Point CP-1 is considered significant with average concentrations decreasing by up to 86%.

8.3.5.7 Sulphate Concentrations Distance

To gain an understanding of the potential natural attenuation of sulphate concentrations downstream, AECOM graphed the Applicant supplied laboratory data for the mine site between October 2018 and October 2019. The following table provides an overview of sulphate concentrations recorded during the period of observation (Table 8-9).

Table 8-9 Overview of sulphate concentrations mine site

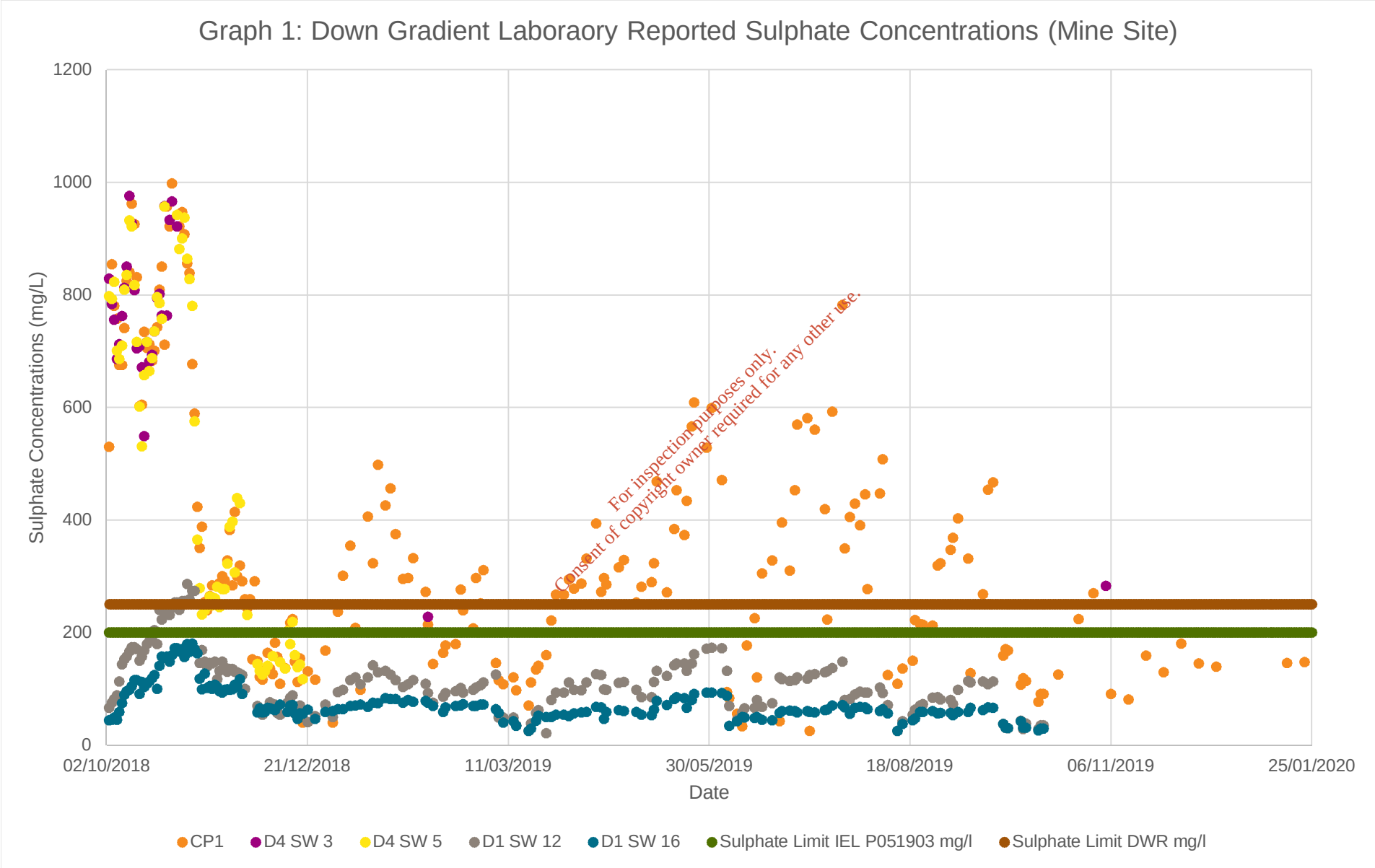
Sampling Point	No. of Readings	Average (mg/L)	Conc. Minimum (mg/L)	Conc. Maximum (mg/L)	Conc.
CP-1	198	354	25	998	
D4-SW3	28	768	228	976	
D4-SW5	66	491	117	957	
D1-SW12	193	114	21	286	
D1-SW16	193	76	25	180	

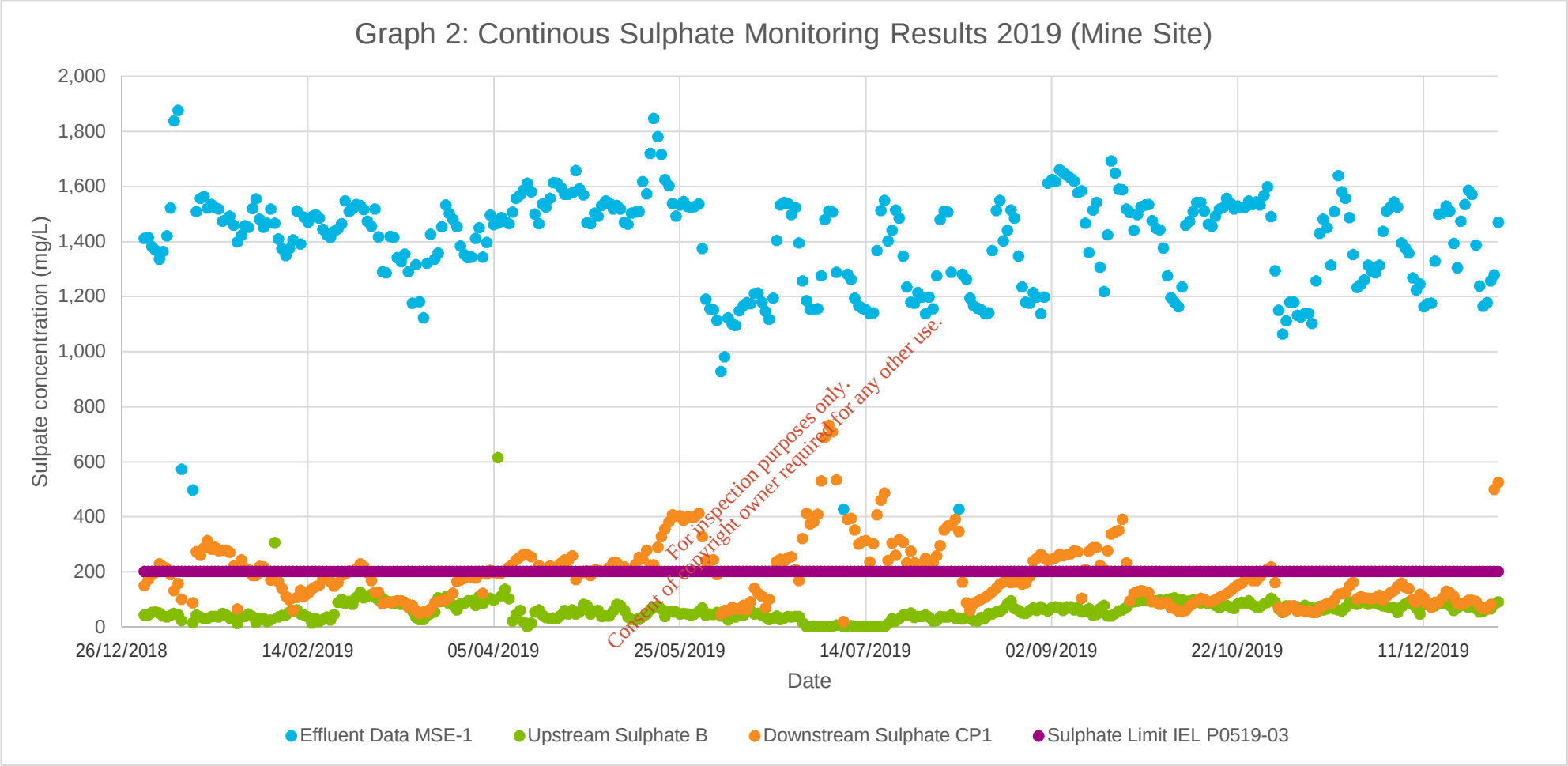
A review of the data illustrated in Graph 3, showed concentrations of sulphate were generally above 200 mg/L up to 2 km downstream of the site (D4-SW5). Surface water 5.6 km downgradient of the site (D1-SW12) was found to be below 200 mg/L.

8.3.5.8 Electrical Conductivity Concentrations

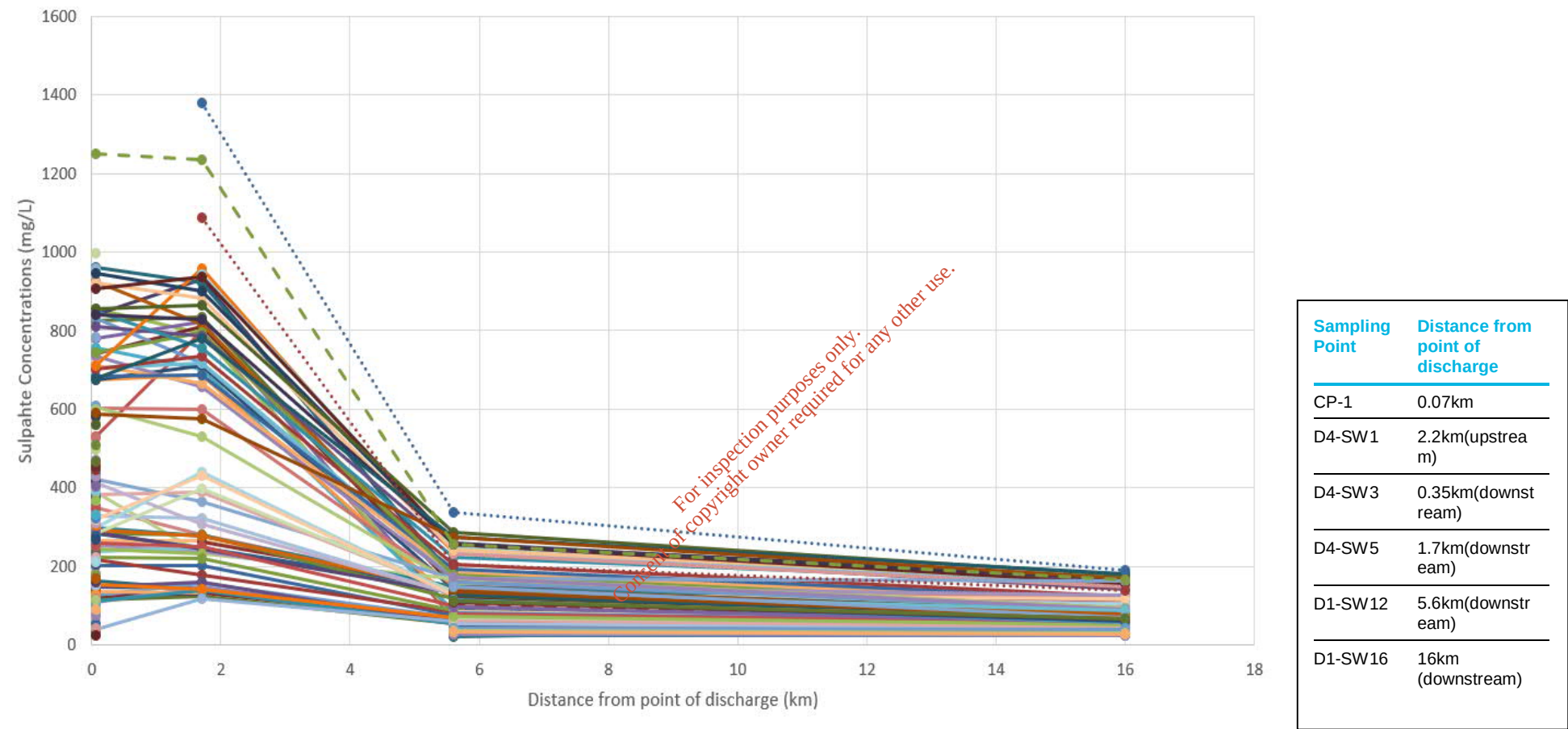
As previously indicated, electrical conductivity is closely correlated with Sulphate concentrations. The graph illustrated in Graph 6, shows the laboratory reported electrical conductivity at locations downstream of the discharge point including, Compliance Point CP-1 (169 data points), and SW16 (170 data points) between October 2018 and January 2020 at the mine site. Of the available data, 41 exceedances of the 1000 $\mu\text{S}/\text{cm}$ ELV were reported during the period observed. It is noted that a large volume of surface water samples was collected between October 2018 and December 2018 in response to the change in water management practices at the site. A large proportion of the exceedances occurred during this period. However, a review of the data shows that the average conductivity for the period was 808 $\mu\text{S}/\text{cm}$.

Conductivity values at SW16 drop to values generally considered typical of surface water with values typically below 600 $\mu\text{S}/\text{cm}$. The average conductivity value recorded at SW16 for the period considered is 492 $\mu\text{S}/\text{cm}$.

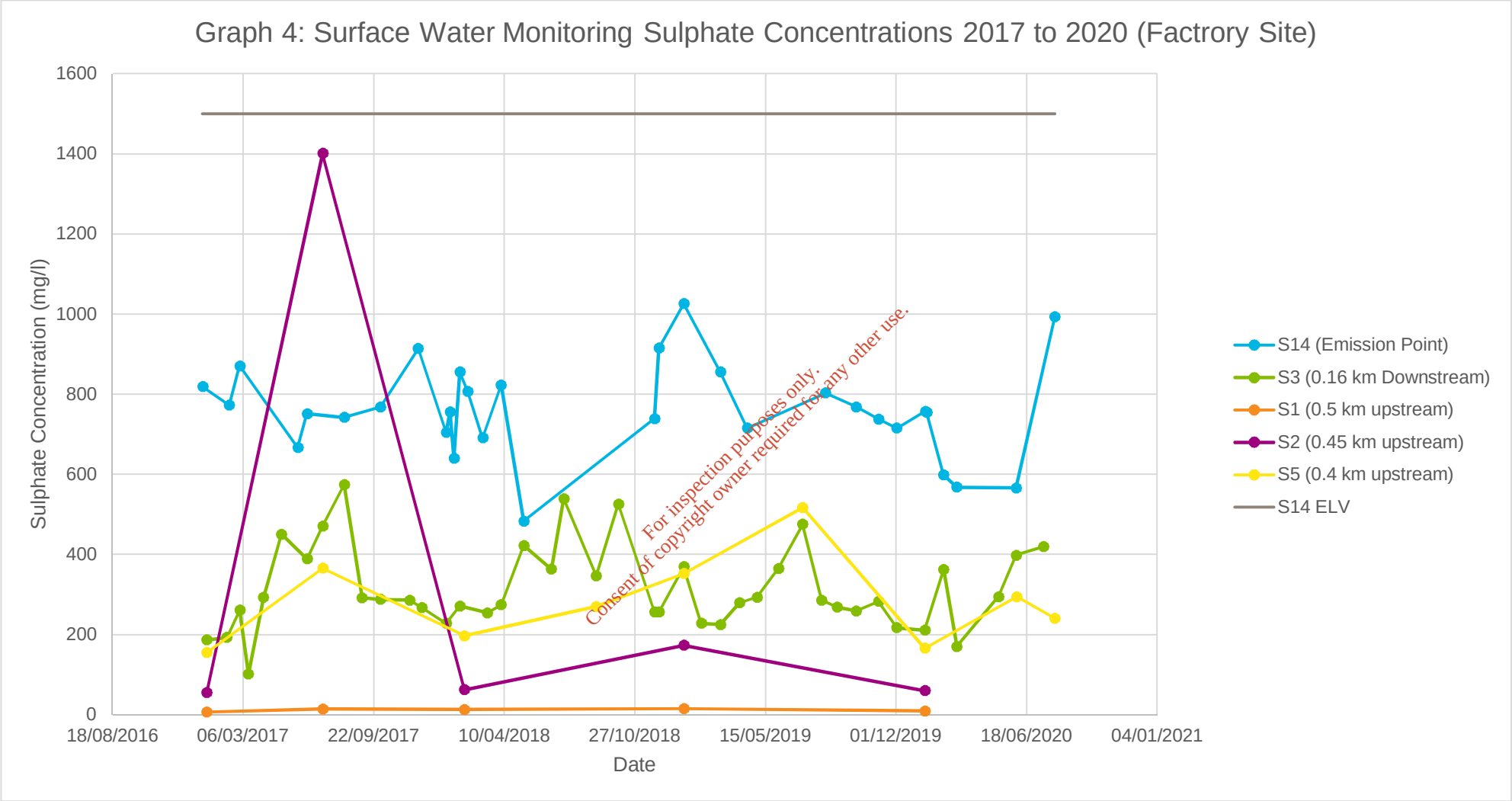


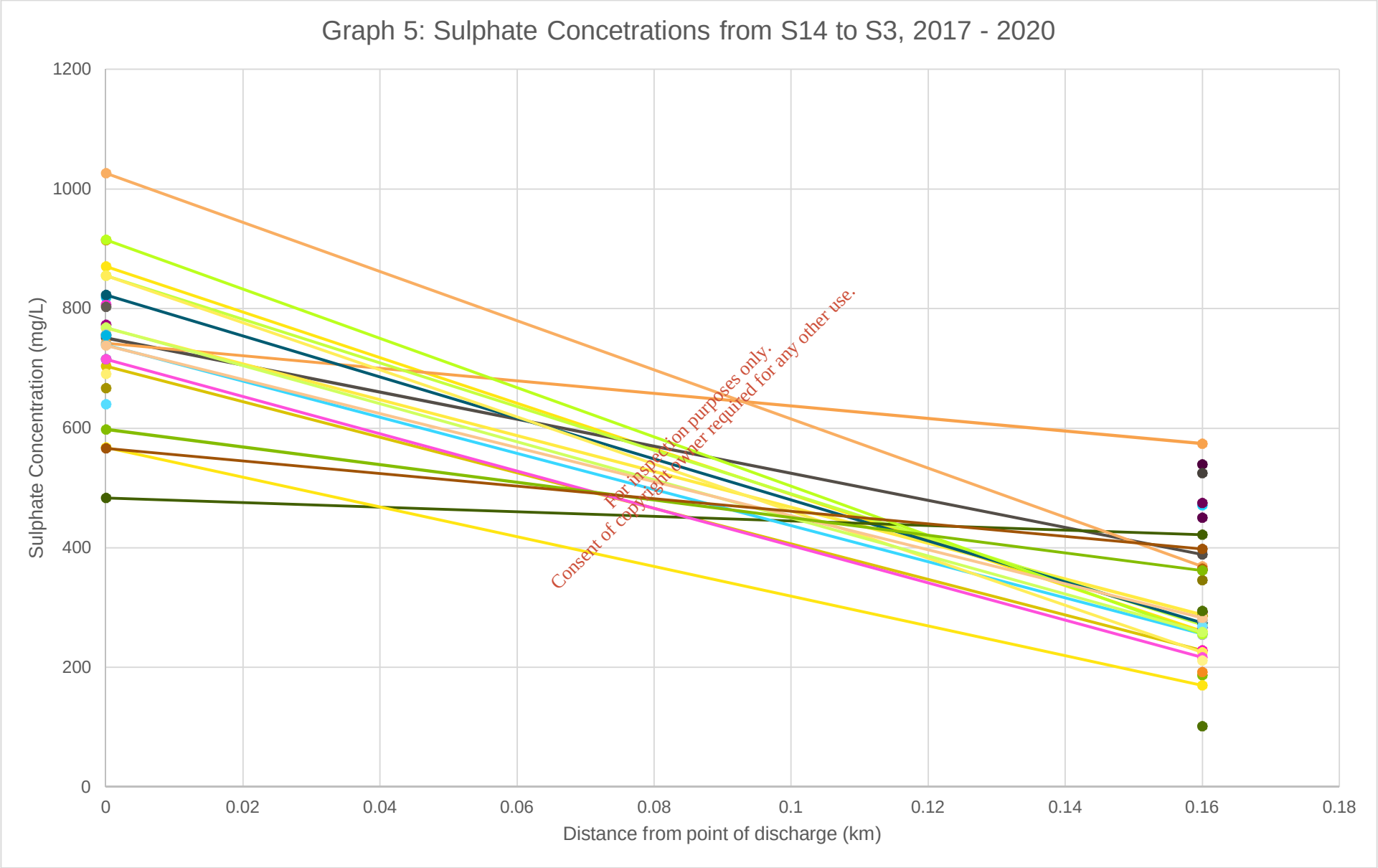


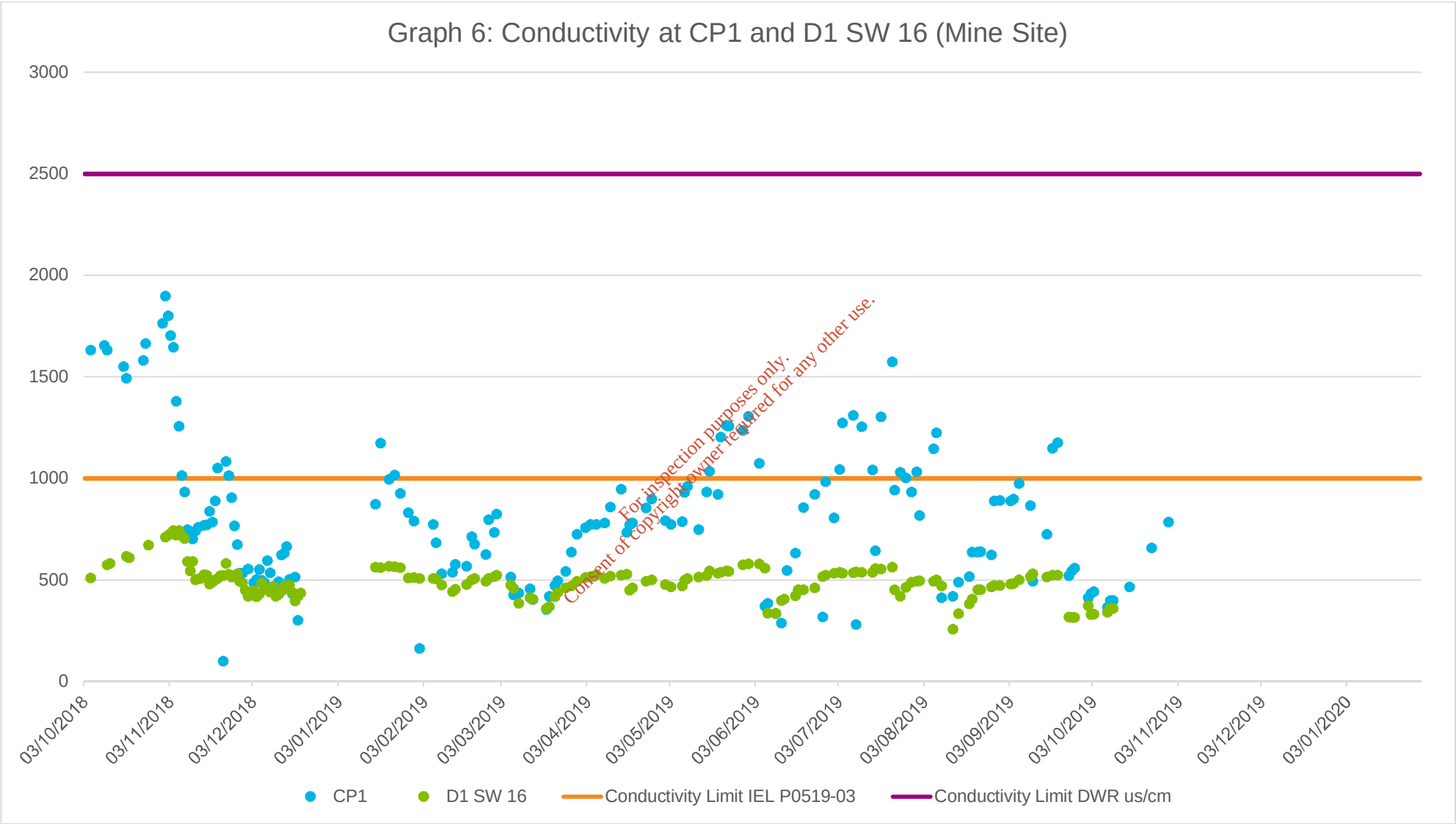
Graph 3: October 2018 to October 2019



Solid Lines: Laboratory data – each line is a set of contemporary samples;
Dashed Line: Predicted concentrations assuming 1,250 mg/L at CP-1
Dotted lines: Upper and Lower Prediction Intervals (Appendix B)







8.4 Description of Existing Environment Factory Site

8.4.1 Site History

The factory site is located south of the town of Kingscourt, across the Cavan County border in County Meath. The site is located in a low lying valley on the eastern edge of the R162. The factory site consists of onsite buildings and hardstanding to the west and a historical onsite landfill to the east of the site, a historical railway line running in a north-south alignment is present on the western landfill boundary. The surrounding landscape is predominantly pastoral fields with associated low density residential housing.

A review of historical maps online suggests the factory site was agricultural land in 1837 – 1842 with three buildings, sheds, present in the north eastern corner of the site. A 'water spout' was mapped in the south-central portion of the site with the area currently occupied by the landfill was vacant land. In 1888-1913 the land appeared to be mostly cleared and the 'water spout' and onsite buildings removed, one small building was constructed in the south of the site. The railway line transecting the current landfill is present with a pipeline or roadway leading from an onsite building.

The Applicant noted some operations were in the area in the late 19th century, the modern-day operation on the factory site commenced in 1936. A review of aerial photographs confirms the operational site layout in 1995 with potential evidence of landfilling operations to the west of the site from this period onwards. The layout and construction of the main building appears similar to current day conditions. Land clearing is noted to the north and west of the site, potentially associated with historical lagoons or storage areas, these areas are filled in by the year 2000. A review of historical photographs did not identify significant onsite land changes between 2000 and current day with the exception of the capping of the landfill and upgraded surface water management system, detailed further in Section 7.3.1.4.

8.4.2 Onsite Landfill

The factory site historically operated a landfill facility utilised for the disposal of wastes arising from the plasterboard manufacturing process. The landfilling practice was active until July 2009 and operated under a waste management plan in compliance with IE licence P0519-03. It is unclear when landfilling commenced onsite, based on a review of aerial photographs it is considered circa 1995.

The landfill consists primarily of waste gypsum plasterboard that was deemed unfit for further processing or sale. The gypsum was deposited in a shredded format or layered in boards, at the time of closure in 2009 the waste stream within the landfill was estimated to be 95% plasterboard and 5% gypsum residue including wet waste, dry edging waste and dry waste. A small percentage of general waste arising from the facility was also disposed of within the landfill, a practice which ceased circa 2003 with the implementation of the waste management plan at the facility.

The landfill is positioned to the east of the factory site with the eastern edge of the landfill bounded by the eastern slope of the valley. West of the landfill is a disused railway with the main processing facility beyond. Agricultural land is present to the north, east and south with associated low-density residential housing. The landfill extends approximately 12m above ground level and included a topsoil berm containing a small volume of gypsum waste at the western boundary near the railway line.

RPS were engaged in 2018 to update the landfill Closure, Restoration and Aftercare Management Plan (CRAMP), originally prepared in July 2009, in accordance with section 10.3 the EPA licence P0519-03. The updated CRAMP details activities which have been undertaken since the closure of the landfill in accordance with the EPA landfill site design manual and best practice including capping of the landfill. The landfill capping construction works commenced in July 2017 and were completed in May 2018 by Wills Bros Ltd. The capping system includes a fully lined LLDPE impermeable liner, gas and surface water geocomposite and one metre of subsoil and topsoil. An aftercare period of 30 years was considered.

The key sensitive receptors identified were surface water, groundwater, human beings, air quality and natural habitats and protected species.

All surface water runoff from the capped landfill is directed through water filter or stone filled drains to the Ballynaclose River (Glyde_010) north of the landfill. This river contains surface water monitoring points as part of the EPA licensed monitoring points.

Groundwater is protected through a leachate management system which was upgraded with the capping in 2017/2018. A leachate interceptor drain is present around the entire perimeter of the landfill draining to the leachate lagoons immediately north of the landfill. Leachate is treated by aeration and settlement. The risk to groundwater from the landfill is considered low based on the relatively low permeability geological setting, high naturally occurring concentrations of sulphate, calcium and manganese and the recently installed landfill cap.

Four surface water / leachate lagoons are present capturing surface water runoff from the factory, leachate from the landfill and surface water runoff from the western portion of the landfill. All lagoons are believed to be underlain by natural clay with the exception of lagoon No.3 which is lined. Elevated ammonia and sulphate have been recorded in shallow groundwater adjacent to the lagoons but is not reflected in downgradient sampling locations. Leachate is treated by aeration and settlement from the north western edge of the landfill (in its most concentrated form) and sequentially through lagoons 1, 2 and 3 during which time suspended materials settle out. Water is pumped from lagoon 3 to 4. Surface water from the west of the landfill can also be diverted straight into Lagoon 4 as required. Water from the settlement lagoons is reused in the plasterboard manufacture process.

Routine environmental monitoring of the landfill is undertaken as part of the aftercare programme including surface water, biological assessment, groundwater level and composition, leachate level and composition and landfill gas. AECOM is not aware of any soil monitoring requirements.

8.4.3 Surface Water Drainage

Surface water drainage surrounding the landfill is outlined in Section 8.4.2. Surface water drainage the for remaining of the site was unknown at the time of writing this report. It is understood that all surface water is directed through EPA emission point, S14 at the northern section of the landfill. As such any surface water contamination that might occur as a result of site practices is being monitored through EPA emission point, S14 and monitoring point S3.

The factory site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite to avoid potential contamination. As part of the licence requirements the factory site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three-year basis with frequent visual inspections. A review of the 2019 Annual Environmental Report (AER) indicated all bunds and containment systems were in acceptable condition at the time.

8.4.4 Geology / Hydrogeology

Data and information relating to the geology / hydrogeology of the site were derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the Applicant.

8.4.4.1 Overburden Geology

According to the EPA mapping tool the Teagasc soils within the factory site consist of made ground with surrounding land described as deep well drained mineral soils, shallow well drained mineral soils and cutover / cutaway peat. The Quaternary subsoils are described as till and gravels derived from lower Palaeozoic sandstones and shales, gravels derived from lower Palaeozoic sandstones and shales and cut over raised peat.

The landfill area to the east of the site comprises of 95% plasterboard and 5% gypsum residue and a small percentage of general waste. It is capped with a fully lined LLDPE impermeable line and one meter of subsoil and topsoil.

The annual groundwater monitoring report (Minerex 2020) states, historical Bord Na Mona drilling at the factory site, reported glacial tills between 3 m to 13 m in thickness across the site while the area around the landfill contained sands and gravels between 4.5 m and 11.5 m thickness.

8.4.4.2 Bedrock Geology and Aquifers

The underling groundwater from the factory site is part of the Louth groundwater body, with the Kingscourt groundwater body east and south of the site.

According to the GSI, the principal bedrock aquifer units in the area are (Figure 8-5):

- The Kingscourt Gypsum Formation (central to the site) and the Westphalian Shales to the northeast are both considered poor aquifers. The GSI describes these as “bedrock which is generally unproductive except for local zones”, and
- The Clontail Formation composed of Silurian Metasediments and Volcanics to the west are classed as a poor aquifer (“bedrock which is generally unproductive except for local zones”).

The groundwater vulnerability within the factory site area is classified as high vulnerability with extreme vulnerability along the western boundary.

A summary of the groundwater body conditions is presented in Table 8-10.

Table 8-10 Groundwater Body

Groundwater Body	Description	Distance from site	2013 – 2018 Status	Trends/Charts 2007 - 2018	Risk
Louth IEGBNI_NB_G_019	Poorly productive bedrock	0 m	Good	Upwards trend Ammonia – Total (as N), Chloride, Conductivity and Orth-Phosphate (as p) Downwards trend Nitrate (as NO ₃)	Review
Kingscourt IE_NB_G_017	Productive fissured bedrock	South east and north	Good	No data available	Not at risk

According to the GSI, the recharge within the of the site footprint is in the order of 100 mm/yr, with areas of higher recharge (>600 mm/yr) observed to the south.

A comparative analysis of groundwater quality monitoring in the vicinity of the factory site was carried out by Minerex (2017). Values in the range of 841 mg/L to 7002mg/L for sulphate, 292 mg/L to 775 mg/L of calcium and 1407 µs/cm to µ3809 s/cm of electrical conductivity were deemed representative of the bedrock lithology. It is noted that the highest values recorded were typically associated with the Dolerite members.

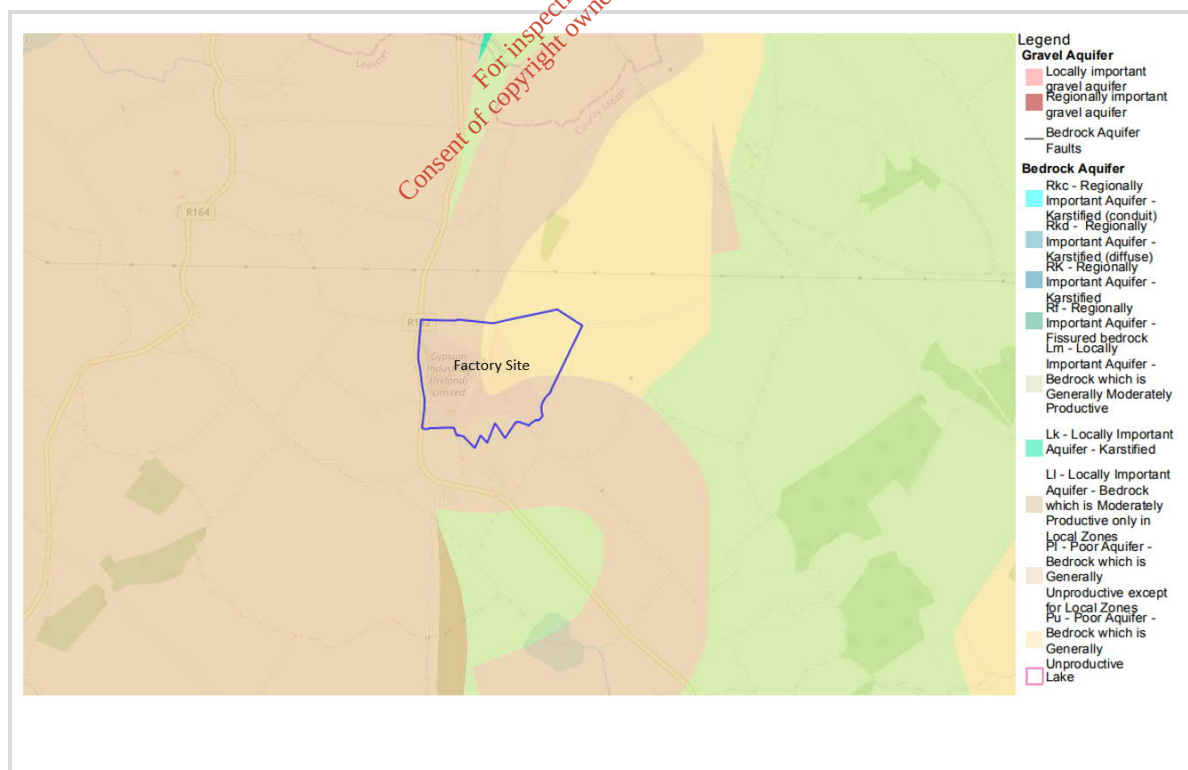


Figure 8-5 GSI bedrock aquifer units (www.epa.ie [Accessed 23/09/2020])

8.4.4.3 Depth to Groundwater and Flow

A review of the GSI online mapping database infers regional groundwater elevation is approximately 70 - 100 m OD, with onsite groundwater expected at 70 m OD. The regional groundwater flow is anticipated to be towards the southeast with the final discharge point the Irish Sea circa 28 km east from the mine site.

A Conceptual Site Model (CSM) developed by Minerex (2017) indicates that groundwater flow is generally mimicking the local topography with local groundwater flow converging towards the valley and then directed north. Minerex also indicates that the groundwater flow from the bedrock aquifer is generally directed upwards hence suggesting a level of protection of the bedrock from contamination sources near the surface.

8.4.4.4 Wells and Groundwater Usage

The factory site contains 15 groundwater monitoring wells for periodic monitoring events in accordance with the EPA licence P0519-03.

A review of source protection zones (SPZ) within a 3 km radius of the site identified two key areas, associated with domestic supply wells in the area. A summary of the findings is presented in Table 8-11.

Table 8-11 Source Protection Zone

Source Protection Zone	Distance from Site	Active	Information
Kingscourt Mullantra PWS BW01	3.4 km north (cross gradient)	Yes	Kings court public water supply is provided by BW01 (500 m ³ /day) and Ervey Lough (500 m ³ /day). Cavan County Council plan to phase out abstraction from Ervey Lough by 2013 and replace it with two additional borehole groundwater sources, outlined below. Localised groundwater flow is east towards the mine site.
Descart wells BW02 and BW03	4.4 km northeast (cross gradient)	No	Two test wells established to replace abstraction from Ervey Lough BW02 and BW03. The wells are currently not listed as active, based on this it is considered public water supply is still sourced from BW01 and Ervey Lough.

AECOM undertook a search of the GSI database for known groundwater wells within a 3 km radius of the factory site. The registered wells, types and accuracy are presented on Volume 3, Appendix A.8.1, Figure A8-4. Groundwater wells to the north were investigated further to assess potential for impacts of sulphate from surface water discharge to groundwater receptors.

Eleven, groundwater wells were noted to the north of the factory site as follows:

- 6 domestic use only
- 1 agricultural & domestic use, and
- 4 public supply (County Council).

Two domestic supply wells are within 500 m of the factory site boundary (2629SEW015 and 2629SEW019). Based on the rural nature of the houses, these and other listed domestic wells in the area are considered in use. The one agricultural / domestic well (2629SEW026) is installed to 5 m below ground level and considered unlikely to be utilised for extensive agricultural / domestic use. The four nearby public supply wells are generally installed shallow with poor yield, the water supply from groundwater in the area is primarily considered to be through private wells and the Kingscourt Mullantra PWS 3.4 km north.

The GSI database of wells is not complete as there is no legal requirement to register wells. Due to the rural nature of the mine site it is considered likely groundwater wells within the area are used for agricultural and domestic purposes.

8.4.5 Water Supply

The factory sites water supply is provided by mains services and abstraction from the Milltown Stream Reservoir, to the west of the site across R162, screened upon entering site at EPA monitoring point S1. Additionally, a portion of factory site water is recycled from the settlement lagoons for use in the processing facility as detailed in Section 8.4.2.

8.4.6 Hydrology

Data and information relating to the hydrological setting of the site were derived from the online GSI 'Spatial Resources Viewer', as well as from previous site investigation reports provided by the Applicant.

8.4.6.1 Surface Water Courses

There are two primary local surface water courses near the factory site, as follows:

- Drainage channel (EPA name: Ballynaclose, IE_NB_06G020070). Running north along the historical railway prior to meeting the River Lagan, and
- Dee River (EPA name: Dee, IE_NB_06D010035). Running west to east along south of the site.

The factory site falls within the WFD 06 - Newry, Fane, Glyde and Dee catchment and sub catchment 06_7 (Glyde_SC_010).

- Glyde_010 (Drainage Channel and thence River Lagan) is 51 km in length with a southern tributary originating within the factory site. Water from the factory site travels in a north direction prior to joining Glyde_020 circa 6 km north east of the factory site, where it travels south east circa 4 km towards Glyde_030 and joins the water from the mine site at the confluence point below Rahans Lough. The Glyde_010 river body is classed as 'not at risk'. There are no up or down stream Q values within the Glyde_010, the nearest recorded Q value is at Glyde_020 with a Score of 4. The river water quality status 2013-2018 is listed as good. It is not listed as a drinking water river, and
- The Dee_020 river water body is circa 400 m south of the factory site. Due to the close proximity of the factory site to Glyde_010 and engineered onsite discharge systems leading to the EPA emission point S14, it is considered unlikely the factory site water will discharge to this point. It has not been considered further in this assessment.

8.4.6.2 Surface Water Pressures

The drainage channel and thence River Lagan leading from the factory site is in a similar setting and land use to the mine site, no surface water pressures additional to those outlined in Section 8.3.5.2 were identified.

8.4.6.3 Offsite Emissions to Surface Water

A review of EPA Industrial Emission (IE) licences surrounding the factory site was undertaken in the Chapter 7 Land and Soils.

Breedon Brick Limited (P0528) as detailed in Section 8.3.5.3 is the only licensed emission to surface water from the same downgradient waterway as the factory site, the River Lagan.

8.4.6.4 Site Emissions to Surface Water

The factory site water emissions comprise of run off from site hardstanding and redirected surface water runoff from the capped landfill. Surface water is directed through interceptors and lagoons as appropriate prior to discharge at S14.

The site has one registered emission point for water, presented in Volume 3, Appendix A.8.1, Figure A8-2 and detailed below.

Table 8-12 Emissions to Water

Name	Type	Location	Receiving water body	Required analysis
S14	Emission Point (Previously S8 under P0-0519-02)	Drainage channel and thence to River Lagan 279012E 292474N	River Lagan	Continuous: Flow Monthly (when discharge is occurring): temperature, pH, conductivity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, settleable solids, sulphate, total ammonia, molybdate reactive phosphorus (MRP), total phosphorus, , mineral oil, copper, total heavy metals, oils, fats and greases. Toxicity monitoring as required by agency.

Limit values for emission parameters set out in EPA Licence P0519-03

8.4.6.5 Surface Water Monitoring

In line with the licence requirements routine surface water monitoring is undertaken by the factory site at four locations.

A summary of the sampling points is presented in Table 8-13 and depicted in Volume 3, Appendix A.8.1, Figure A8-2.

Table 8-13 Monitoring Data

Monitoring Point	Distance from point of discharge	Location	Required Analysis
S5	0.4 km (upstream)	Upstream of S14 279109E 292084N	Bi- annual: Conductivity, pH, temperature, DO, BOD, Suspended Solids, Nitrate, Nitrite, Ammonia (as N), MRP (as P), Total Phosphorus (as P), Sulphate, Chloride, Heavy metals.
S3	0.16 km (downstream)	Downstream of S14 279015E 292642N	Bi- annual: Conductivity, pH, temperature, DO, BOD, Suspended Solids, Nitrate, Nitrite, Ammonia (as N), MRP (as P), Total Phosphorus (as P), Sulphate, Chloride, Heavy metals.
S1	0.5 km (upstream)	Incorrect co-ordinate provided on licence	Annually: Conductivity, pH, temperature, DO, BOD, Suspended Solids, Nitrate, Nitrite, Ammonia (as N), MRP (as P), Total Phosphorus (as P), Sulphate, Chloride, Heavy metals.
S2	0.45 km (upstream)	Incorrect co-ordinate provided on licence	Annually: Conductivity, pH, temperature, DO, BOD, Suspended Solids, Nitrate, Nitrite, Ammonia (as N), MRP (as P), Total Phosphorus (as P), Sulphate, Chloride, Heavy metals.

AECOM reviewed data sources provided by the Applicant. The following sources of data were reviewed:

- Laboratory reported surface water results from S1, S2, S3, S5 and S14 at the factory site from 2017 to 2020.

The above-mentioned monitoring points are depicted on Volume 3, Appendix A.8.1, Figure A8-1 and A8-2.

The data reviewed indicates that the water quality of the emissions from the factory site has been generally compliant with the ELVs imposed by the licence (only moderate exceedances of for ammonium were observed in 2017). Therefore, the following paragraphs will focus on sulphate in consideration of the Proposed Licence Amendment.

8.4.6.6 Sulphate Concentrations Time

The graph illustrated in Graph 4, shows the laboratory reported sulphate concentrations upstream of the emission point at the factory site, S1 (5 data points), S2 (5 data points), S5 (9 data points), at the emission point, S14 (760 data points) and downstream S3 (314 data points). No notable seasonal trend in sulphate concentrations (compared summer and winter months) was noted at the emission point, S14. Reported concentrations downstream at S3 were noted to be higher during July to October with the highest reading of each year falling into this period as follows:

- 470 mg/L on 6 July 2017
- 574 mg/L on 8 August 2018
- 475 mg/L on 11 July 2019, and
- 419 mg/L 14 July 2020.

Concentrations outside of these months were generally below 400 mg/L.

Overall, sulphate concentrations were significantly below the EPA ELV of 1,500 mg/L at the emission point (S14), including concentrations upstream and downstream, with no single value exceeding this concentration in the past 3 years.

8.4.6.7 Sulphate Concentrations Distance

AECOM graphed the Applicant supplied laboratory data for the factory site from 2017 to 2020 (August). The following table provides an overview of the sulphate concentrations recorded.

Table 8-14 Overview of Sulphate Concentrations Factory Site

Sampling Point	No. of Readings	Average (mg/L)	Conc. Minimum (mg/L)	Conc. Maximum (mg/L)	Conc.
S14 Emission Point	31	760	483	1026	
S3 downstream	42	314	101	574	
S1 upstream	5	12	6	15	
S2 upstream	5	350	55	1401*	
S5 upstream	9	284	155	517	

*Value appears to be an outlier, all remaining values at S2 below 200 mg/L.

Sulphate concentrations near the entry of the site, at S1 were found to be lowest with average concentrations 12 mg/L. As surface water progresses to the landfill an increase is seen at S2 and S5 and subsequently at the Emission Point, S14.

Utilising the Applicant supplied data for the emission point, S14 and downstream monitoring point S3 a trend graph was plotted to assess the sulphate concentrations over distance, presented in Graph 5. The graph shows a strong decreasing trend in sulphate concentrations from the discharge point to the downstream emission point 160 m downstream with average concentrations decreasing from 760 mg/L to 314 mg/L, a 41% decrease. There are no further known monitoring points downstream of S3, until after the water reaches the confluence point with the mine effluent, south of Rahans Lough. Downgradient concentrations from this point are captured in sampling points SW12 and SW14. As such, potential impacts caused by the combination of the factory site and mine site water would be represented in SW12 and S14 monitoring.

8.5 Assessment of Potential Impacts

This Chapter considers the impacts of the Proposed Licence Amendment on the hydrology and hydrogeology of the area. Biological and ecological receptors are considered in Chapter 6 Biodiversity and will therefore not be considered further in this assessment.

8.5.1 Features Screened Out of Impact Assessment

8.5.1.1 Discharge Flow Rate

It is noted that the Proposed Licence Amendment does not affect the allowable volume of discharge. The current licence limit for discharge flow is 510 m³/h (or 12,240 m³/day). The historical data reviewed for the mine site (Table 8-3) indicates that the discharge volumes are generally lower than the discharge allowed under the current Licence. It is also noted that discharge is expected to be occurring year-round rather than being concentrated during the wetter months of the year. Therefore, flooding and flow have not been considered further in the assessment.

Flow rates from the factory site are not to be impacted by the Proposed License Amendment and have not been considered further in this assessment.

8.5.1.2 Water Quality

Emission monitoring data from the factory site reviewed between 2017 and August 2020 has been generally compliant with the EPA monitoring requirements and limits as set out in the licence and water quality at the factory site will not be impacted by the Proposed Licence Amendment. It is also noted that concentrations of sulphate downstream of S14 return to essentially background levels within 160 m of the point of discharge and are therefore unlikely to affect water quality beyond this point. Therefore water quality of discharges from the factory site will not be considered further in this assessment. Notwithstanding, in combination effects, downstream of the confluence point will be addressed where deemed relevant.

While the Proposed Licence Amendment includes an increase to the electrical conductivity ELV, this is strictly associated with the sulphate concentrations observed. Since sulphate impacts are deemed to be more significant than those potentially effected by conductivity the latter will not be assessed and sulphate will be considered as a proxy for electrical conductivity in the assessment.

8.5.2 Determination of Sensitive Receptors

The following sensitive receptors have been identified:

- The River Bursk and River Lagan / Glyde (Glyde_030)
 - Downgradient surface water abstraction points and users including Tallanstown pumping station.
- Groundwater beneath the River Bursk and River Lagan / Glyde (Glyde_030)
 - Downgradient shallow domestic and agriculture supply wells to local residents and shallow groundwater quality near the mine site.

8.5.2.1 Surface Water Abstractions

Abstraction of surface water for domestic or agricultural use is considered to be potentially impacted by the increase of sulphate concentrations by the Proposed Licence Amendment.

The mine and factory site fall within the Newry-Fane-Glyde-Dee catchment. A review of the Newry-Fane-Glyde-Dee Catchment Assessment (EPA 2018), noted 44 drinking water abstractions in the Fane Glyde Catchment, comprising of 8 group water schemes and 16 public supplies. Of these:

- 31 of the abstractions are from groundwater bodies
- 3 from lakes, and
- 10 from rivers.

The only drinking water abstraction identified within the Glyde water body was scheme 2100PUB1005, Glyde_50 Tallanstown.

Tallanstown public water supply (PWS) abstraction is located approximately 18 km downstream from the mine site within Louth County Council. The supply volume for the abstraction point is 450 m³/day serving a population of 1,978 people. The local land use is agricultural, with a cereal crop growing in the field across the river from the water treatment plant. Water is abstracted adjacent to the plant from the River Glyde and treated by coagulation, flocculation and clarification using aluminium sulphate, filtration and disinfected using sodium hypochlorite generated by on site electrochlorination (OSEC). EPA audits undertaken at the site have previously noted vehicle tracks close to the river with potential concern for pesticide spraying too close to the river. Pesticides were previously detected in the water supply in October 2018.

Two EPA drinking water audits have been completed at Tallanstown pumping station, on 04 December 2018 and 02 August 2019. Tallanstown PWS is recorded on the remedial action list (RAL), a record of public water supplies known to be at risk. The EPA has requested corrective action by Irish Water, with regards to the plant by December 2020. It is noted that none of the corrective actions related to concerns associated with sulphate levels in the supply. One of the proposed corrective actions is complete replacement of supply with Cavanhill PWS.

EPA Audit Inspection 4 December 2018

- The condition of the rapid gravity filter at Tallanstown water treatment plant was poor. Irish Water should ensure the filter is cleaned and assessed with a view to replacing the filter media and verifying the performance of the filter bed pipework
- The sampling point for the chlorine residual monitor is located within the clearwater tank and therefore the trend in residual chlorine is unrepresentative. Irish Water should relocate the chlorine residual sample point to a location after contact time for chlorine disinfection has been achieved, and
- Chemical dosing on-site is manually controlled. The dosing rate is based on turbidity readings but there is no system of jar testing to inform the manual dose changes. Irish Water should ensure that facilities are provided to allow regular jar testing, to determine the optimum chemical coagulant dose and pH for the treatment of water.

EPA Audit Inspection 2 August 2019

An EPA audit inspection was carried out in response to problems with the treatment processes on site and in the distribution network which resulting in exceedances of Drinking Water parametric values and a 'boil water notice' being imposed on the entire Tallanstown public water supply on 30.07.2019. A number of audit findings from previous assessment remain to be completed.

The following key findings were noted:

- There was a failure of treatment barriers at Tallanstown Water Treatment Plant during the period 19/07/2019 to 26/07/2019; however, this was not escalated to Irish Water until 26/07/2019. A Boil Water Notice was placed on the supply on 30/07/2019, twelve days after the first indications that the treatment processes were compromised. This delay posed an unacceptable risk to public health for the consumers of Tallanstown Public Water Supply
- The chlorine contact time and chlorine residuals required to ensure adequate disinfection of the water supply were not suitably controlled and managed at the plant. Irish Water should ensure that this is immediately addressed in advance of works which are planned under the Disinfection Programme for Co. Louth, and
- Due to the observed lack of control over the plant disinfection, coagulation, flocculation, clarification and filtration processes at Tallanstown Water Treatment Plant, the EPA has separately issued a Regulation 9(2) Direction to Irish Water which requires an Action Programme to be provided by 23/08/2019 outlining how Irish Water intend to improve the security of the supply and ensure that consumers of Tallanstown Public Water Supply receive adequately treated water.

8.5.2.2 Groundwater Abstractions

It is considered likely a shallow groundwater aquifer within the till derived from lower Palaeozoic sandstones and shale is present surrounding the mine site. Shallow groundwater aquifers are generally located 0 m to 10 m bgl. As such, shallow groundwater beneath Glyde_030 is considered a potential sensitive receptor to the proposed increased sulphate concentrations. The shallow groundwater near the factory site is not to be impacted as part of the Proposed License Amendment, as such has not been considered further.

The GSI database was searched for known groundwater wells within a 3 km downgradient radius of the mine site and factory site. The registered wells, types and accuracy is presented on Volume 3, Appendix A.8.1, Figure A8-3 and Figure A8-4.

Sixty-five, groundwater wells were noted downgradient of the mine site, with the closest downgradient domestic use well (2629SEW178) circa 1.5 km south of the mine site, the well is drilled to 52.7m bgl with a good yield of 327 m³ per day. An agricultural domestic well (2629SEW133) is located 1.4 km south of the mine site, the well is hand dug to 1.2 m, no yield information is available, due to the shallow nature of the bore it is considered unlikely it is used for extensive agricultural / domestic use. The Kingscourt Mullantra PWS public water supply is located 1.2 km south west of the mine site.

8.5.3 Description of Potential Effects

To gain an understanding of the sulphate concentrations within Glyde_030 and the potential for increased concentrations associated with the Proposed Licence Amendment, AECOM reviewed three data sources provided by the Applicant. Additionally, predicted effects were calculated for a maximum sulphate discharge of 1,250 mg/L (at Compliance Point CP-1).

Utilising the Applicant supplied data for downstream concentrations of sulphate from Compliance Point CP-1, trend graphs were plotted to model the estimated downstream concentrations of sulphate assuming a sulphate concentration of 1,250 mg/L at Compliance Point CP-1. The upper and lower prediction intervals for the trend lines were calculated. Owing to the limited data set available at D4-SW3 this location was excluded from the modelling exercises. The correlation graphs and the information supporting the model calculations are presented in Volume 3, Appendix A.15.2 and the resulting line on Graph 3.

As shown in the graph it is estimated that, assuming a sulphate concentration of 1,250 mg/L at Compliance Point CP-1, the corresponding concentration observed at D1-SW12 (ca. 5.6 km downstream) would be 256.99 mg/L with an upper prediction limit of 352.01 mg/L and a lower prediction limit of 161.96 mg/L. The estimated concentration at D1-SW16 is 165.41 mg/L with an upper prediction limit of 190.5 mg/L and a lower prediction limit of 140.32 mg/L. It is noted that the significant drop in concentration observed between D4-SW5 (1234 mg/L) and D1-SW12 (256.99 mg/L) would likely be associated with the influx from the catchment of Glyde_10 which merges with the Glyde_30 approximately 2 km downstream Compliance Point CP-1.

8.5.3.1 Drinking Water Receptors

Sulphate is naturally occurring in the environment due to the presence of earth minerals such as barite (BaSO₄), epsomite (MgSO₄.7H₂O) and gypsum (CaCO₃.2H₂O). The potential risk to surface and groundwater drinking water abstractions can be assessed based on drinking water standards. The World Health Organisation (WHO) (WHO 2004) has established a guideline value for sulphate concentrations in drinking water of 250 mg/L which has also

been adopted in Irish regulations as the parametric value for drinking water with European Union (Drinking Water) Regulations 2014 (S.I. 122/2014). In the WHO study, no health-based guideline value for sulphate in drinking water was proposed, however an increased likelihood of complaints arising from a noticeable taste as concentration in water increase above 500 mg/L was noted.

The laboratory data reviewed as well as the estimated concentrations for the proposed ELV at 1,250 mg/L would indicate that concentrations of sulphate greater than 250 mg/L would be limited to the section of stream between Compliance Point CP-1 and the confluence with the GLYDE_10 (ca. 2.0 km). While it is reasonable to conclude that the river is a gaining stream, modest riverbed infiltration cannot be excluded. However, this would be limited to shallow groundwater locally and the volume infiltrated over such a short distance is unlikely to affect the overall groundwater quality. This is further mitigated by the general presence of low permeability soils observed in the area. It is therefore considered unlikely that any impact on local groundwater abstractions would be affected by the increased sulphate discharge. It is noted that the proposed electrical conductivity is below the parametric value of 2,500 $\mu\text{S}/\text{cm}$.

A known drinking water abstraction (Tallanstown pumping station) is located circa 18 km downstream of Compliance Point CP-1. However, water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge.

Therefore, it is concluded that there will be a not significant effect on the receptors considered.

8.5.3.2 Groundwater Receptors

The potential risk to groundwater can be assessed in consideration of European Communities Environmental Objectives (Groundwater) Regulations, 2010. Statutory Instrument No. 9 of 2010 (as amended S.I 366 of 2016). The Groundwater Regulations set out a groundwater standard of 187.5 mg/L based on 'assessment of the general quality of groundwater in a groundwater body in terms of whether its ability to support human uses has been significantly impaired by pollution'.

The laboratory data reviewed indicates that the limit of 187.5 mg/L was never exceeded at SW12 and SW16. However, the estimated concentration at SW12 (assuming 1,250 mg/L of sulphate at Compliance Point CP-1) would be above this limit. While it is reasonable to conclude that the river is a gaining stream, modest riverbed infiltration cannot be excluded. However, this would be limited to shallow groundwater locally and the volume infiltrated over such a short distance is unlikely to affect the overall groundwater quality. This is further mitigated by the general presence of low permeability soils observed in the area and the low level of hydrogeological connectivity between the overburden and the bedrock.

Therefore, it is concluded that there will be an imperceptible effect on the receptors considered.

8.5.3.3 Surface Water Receptors

An Environmental Quality Standard (EQS) for sulphate is not provided in the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009 as amended). Therefore, the drinking water Parametric Value (PV) of 250 mg/L is referred to here as a conservative generic assessment criteria (GAC). The risk of acute toxicity and other acute effects associated with sulphate are deemed to be unlikely. Therefore, annual average values were considered in the assessment.

Overall, the concentration of sulphate is observed to increase downstream of the point of discharge. Based on the continuous monitoring data for the period of 2019 the average concentration of sulphate increases from 59 mg/L (at point B) to 191 mg/L (at Compliance Point CP-1). This is generally consistent with the laboratory data which shows an average sulphate concentration at Compliance Point CP-1 275 mg/L (it should be noted that Compliance Point CP-1 is sampled more often when an exceedance is recorded possibly skewing the results negatively). It is noted that the continuous monitoring data at Compliance Point CP-1 is below the GAC whereas the laboratory data set provides a result which is only slightly elevated above the selected GAC. This would indicate that the significance of the impact on water quality based on actual data collected is negligible.

Based on the modelling exercise carried out in which the concentration recorded at Compliance Point CP-1 is assumed to be 1,250 mg/L (the proposed revised ELV), the estimated concentration at SW12 (5.6 km downstream) would be between 256.99 mg/L with an upper prediction limit of 352.01 mg/L and a lower prediction limit of 161.96 mg/L indicating that any impact would be limited to this initial stretch of the stream. However, it is noted that the significant drop in concentration observed between Compliance Point CP-1 and SW12 would likely be associated with the influx from the catchment of GLYDE_10 which merges with the GLYDE_30 approximately 2 km downstream of the point of Compliance Point CP-1. It can therefore be inferred that, in an extreme scenario where discharge is consistently at 1,250 mg/L of sulphate, only approximately 2 km of stream would display annual

average concentrations greater than 250 mg/L. This would indicate that the significance of the impact on water quality is low to negligible.

Therefore, it is concluded that there will be a not significant effect on the receptors considered.

8.6 Mitigation Measures

Considering the not significant effects expected no mitigation is currently proposed in terms of water quality. However, since predictions are based on a limited data set, additional monitoring is proposed in respect to the confluence of GLYDE_10. Monitoring shall confirm that the stretch of stream impacted above 250 mg/L of sulphate is limited to the section upstream of the confluence. Therefore, monitoring shall take place as follows:

- Weekly monitoring of water quality shall be implemented on a regular on-going basis in the GLYDE_30 a short distance downstream of the confluence with the GLYDE_10. This will confirm that the concentration of sulphate in the water downstream of this point does not exceed 250 mg/L;
- Should the sulphate level be recorded above 250 mg/L at this location, appropriate investigative action shall be carried out in consultation with the EPA and corrective actions implemented as determined by the investigation findings and/or subsequent assessment.

It is noted that a similar monitoring regime is recommended in Chapter 6 Biodiversity. As such, a suitable location could be determined to fulfil both requirements.

8.7 Cumulative Impacts

The assessment conducted in paragraph 8.5 above is based on actual data collected from the receiving waters. As such the data collected would be reflective of existing cumulative effects. Actual data has been used to estimate the predicted concentrations (assuming a sulphate concentration of 1,250 mg/L as CP-1) and would also account for cumulative effects. Where these have not been captured by the current assessment it is inferred that these involve distinctly dissimilar discharges and processes and would therefore not give rise to cumulative effects. Therefore, no further assessment is deemed necessary.

It is noted that the cumulative effects from the discharge at the mine site, factory site and nearby IE licence site, Breedon Brick Limited would be captured by surface water monitoring points SW12 and SW16. A review of data from these monitoring points did not show a significant cumulative effect of sulphate concentrations. The surface monitoring frequency and analysis at the factory site was compliant with requirements in the EPA licence in the period reviewed between 2017 and August 2020. AECOM is not aware of additional planned discharge permits in the area of influence.

8.8 Residual Impacts

Given the availability of surface water data for a period in which the revised water management strategy has been already in place, the residual impacts would be those set out in this assessment which are deemed to result in effects which are not significant or imperceptible.

8.9 Summary

The table below summarises the findings of the assessment (Table 8-15).

Table 8-15 Summary of Impacts

Receptor	Description of Impact	Existing Environment	Significance of Effect
Drinking Water Receptors, Groundwater Abstractions	Negligible	Impacts on local groundwater would be limited to the local shallow groundwater immediately downstream of the point of discharge and would not affect the overall groundwater quality in relation to the Sulphate PV (250 mg/L). Additionally, the likelihood of abstractions from shallow groundwater being employed for drinking water supply is low. This is further mitigated by the presence of low permeability overburden in the area.	Medium-High
Drinking water abstractions in the area are limited to individual supply wells for farming and single households. Where an exceedance is noted this would affect taste rather than posing a health risk.	Not Significant		
Drinking Water Receptors, Surface Water Abstractions	Negligible	Impacts on surface water would be limited to section immediately downstream of the point of discharge (ca. 2km) and do not affect water quality at known abstraction points in relation to the Sulphate PV (250 mg/L).	High
Drinking water abstractions in the area include Tallanstown PWS serving a population of 1,978 people. Where an exceedance is noted this would affect taste rather than posing a health risk.	Not Significant		
Groundwater Quality	Negligible	Impacts on local groundwater would be limited to the local shallow groundwater immediately downstream of the point of discharge and would not affect the overall groundwater quality in relation to the Sulphate EQS (187.5 mg/L). This is further mitigated by the presence of low permeability overburden in the area.	Low
Existing environment characterised by agricultural practices and shallow groundwater is likely already impacted. Hydrogeological connectivity between the overburden and bedrock is very poor.	Imperceptible		
Surface Water Quality	Low to Negligible	Impacts on surface water would be limited to section immediately downstream of the point of discharge (ca. 2 km).	Low to Negligible
Existing environment is affected by agricultural pressures and channel has been altered historically.	Not Significant		

9 Air Quality

9.1 Introduction

This chapter considers air quality related impacts associated with the Proposed Licence Amendment to increase the ELV for sulphate and electrical conductivity at Compliance Point CP-1 (see Volume 3, Appendix A.3.1, Figure A3-1) within the mine site (as detailed further below).

The Applicant's existing operations at both the mine and factory site are licenced by IEL P0519-03, as issued by the EPA (see Chapter 1 Introduction and Chapter 3 Project Description for further information). At the mine site the predominant airborne emission is dust from processes such as the excavation of raw gypsum, processing of raw gypsum materials and transport of such materials. While at the factory site, airborne emissions occur from processing activities in areas such as the plaster mill and at the board plant dryer.

Both dust deposition and air emissions limits from the mine and factory sites are licenced and monitored in accordance with the conditions set out within IEL P0519-03. Air emissions limits apply to the factory site only while dust deposition limits apply to both the mine and factory site.

The Proposed Licence Amendment relates to a change in the ELV of sulphate from 200 mg/L to 1,250 mg/L and the ELV of electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 at the mine site only. The Proposed Licence Amendment will not require any additional infrastructure to be constructed or any existing infrastructure to be altered.

The Proposed Licence Amendment is not required as a result of, or to accommodate an intensification of operations at the site which could give rise to increased emissions. Furthermore the deposition and emission limits as set out in the licence would remain unchanged and the applicant would be required to demonstrate continuous conformance with these. The Proposed Licence Amendment does not look to alter any air quality emissions limits or monitoring requirements as outlined within IEL P0519-03.

9.2 Methodology

An environmental baseline was established using information available from resources such as information contained within an EIAR prepared by Golder Associates to support an application made by the Applicant in 2017 to Monaghan County Council in order to continue mining operations under IEL P0519-03, information provided by the Applicant, information contained within the Annual Environmental Report (AER) for the mine and factory site and supporting information provided by the Applicant.

As mentioned above, the Proposed Licence Amendment relates to a change in the ELV of sulphate from 200 mg/L to 1,250 mg/L and electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 at the mine site only and is not expected to alter air quality emissions limits or monitoring requirements as outlined within IEL P0519-03 relating to the factory or mine site. As a result, it was determined that a detailed quantitative air quality assessment, (such as air quality modelling) was not required. More appropriately, a qualitative assessment of the Proposed Licence Amendment has been undertaken to assess the potential for air quality impacts.

9.2.1 Sources of Information

Information included within this chapter was based on a number of sources of information such as those outlined below.

- EPA IEL P0519-03 (EPA 2015)
- Knocknacran Open-pit Mine, Environmental Impact Assessment. Report Number 1668466.R01.EIS.A0 submitted to Monaghan County Council. (Golder Associates 2017).
- Annual Environmental Report 2018 (SGCPI 2018), and
- Annual Environmental Report 2019 (SGCPI 2019).

9.2.2 Legislation and Guidance

The IEL P0519-03 for the factory and mine site has been issued by the EPA under the provisions of the Environmental Protection Agency Act 1992 [as amended].

9.2.2.1 Industrial Emissions Licensing

As a result of a European Commission review of European legislation on industrial emissions, the Industrial Emissions Directive (2010/75/EU) (EU 2010) came into force on 6th of January 2011. Transposed into Irish legislation, the Industrial Emissions Directive (IED) changed the existing situation and introduced a third class of licence that can be granted by the EPA, the IEL.

The European Union (Industrial Emissions) Regulations 2013, S.I. 138 of 2013 primarily amended the EPA Act 1992 [as amended] and the Waste Management Act 1996 [as amended], to transpose Chapters II and VI of Directive 2010/75/EC of the European Parliament and of the Council of 24th November 2010 on industrial emissions (Integrated Pollution Prevention and Control) (Recast). The Regulations apply to the industrial emissions directive activities specified in the First Schedule to the Environmental Protection Agency Act 1992 [as amended] by these Regulations. The Regulations also include other consequential amendments to regulations affected by the transposition of Chapter II of the Directive.

The Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations 2013, S.I. 137 of 2013 provide for various procedural matters in relation to the integrated licensing by the EPA of Industrial Emissions Directive activities specified in the First Schedule to the EPA Act 1992 [as amended], and transposes Directive 2010/75/EU of the European Parliament and of the Council of 24th November 2010 on industrial emissions (IPPC) (Recast).

The Regulations provide for applications for licences, reviews of licences or revised licences, consideration by the EPA of objections, including the holding of oral hearings, public participation procedures associated with the industrial emissions licensing system administered by the EPA and the contents of the register of licences. As part of these regulations, the EPA is required to have regard, in fulfilling its duty under section 83(4)(a) of the EPA Act of 1992 [as amended], to the principal polluting substances listed in the Schedule. In the context of air quality, the indicative list of principal polluting substances to be taken into account by the EPA for the fixing of emission limit values are as follows (note not all of these are specifically relevant to the operations associated with the mine and factory sites):

- Sulphur dioxide and other sulphur compounds
- Oxides of nitrogen and other nitrogen compounds
- Carbon monoxide
- Volatile organic compounds
- Metals and their compounds
- Dust including fine particulate matter
- Asbestos (suspended particulates, fibres)
- Chlorine and its compounds
- Fluorine and its compounds
- Arsenic and its compounds
- Cyanides
- Substances and mixtures which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air, and
- Polychlorinated dibenzodioxins and polychlorinated dibenzofurans.

9.2.2.2 Aspects of IEL P0519-03 Relating to Emissions to Air

IEL P0519-03 sets out a number of conditions including emissions limits and monitoring requirements relating to both the mine site and the factory site. Several of these are related specifically to air quality and emissions to air and are described below.

Condition 5 (Emissions) includes a number of requirements which aim to provide for the protection of the environment by way of control and limitation of emissions. These include:

- No specified emission from the installation shall exceed the emission limit values set out in Schedule B: Emission Limits. There shall be no other emissions of environmental significance
- No emissions, including odours, from the activities carried on at the installation shall result in an impairment of, or an interference with amenities or the environment beyond the installation boundary or any other legitimate uses of the environment beyond the installation boundary
- The licensee shall ensure that mud, dust and litter associated with the activity do not result in an impairment of, or an interference with, amenities or the environment at the installation or beyond the installation boundary or any other legitimate uses of the environment beyond the installation boundary, and
- Trucks or other vehicles used for transport of excavated or crushed materials from the installation shall be covered to prevent the creation of nuisance on public roads.

Condition 6 (Control and Monitoring) includes a number of requirements relating to emissions to atmosphere. These include:

- The licensee shall prepare to the satisfaction of the EPA, a test programme for abatement equipment installed to abate emissions to atmosphere. This programme shall be submitted to the EPA in advance of implementation
- The licensee shall prepare a programme, to the satisfaction of the Agency, for the identification and reduction of fugitive emissions using an appropriate combination of best available techniques. This programme shall be included in the Environmental Management Programme
- The licensee shall maintain nine dust deposition sampling stations at the currently agreed locations in the vicinity of the mine site and processing site and at any other location as may be required by the EPA
- The licensee shall maintain an on-going programme for improved containment of dusts in the externally-located material loading, storage and conveying systems at the installation. This programme shall be included in the Environmental Management Plan (EMP)
- Dust emissions from exposed earthworks, on-site roads and other services shall be minimised. Mobile bowlers shall be employed to dampen such surfaces during dry weather conditions, and
- Machinery operating on-site shall be switched off when not in use. Where this is not possible, diesel engines shall be throttled down to minimise exhaust emissions.

'Schedule B Emission Limits' of IEL P0519-03 outlines a number of emissions limits of relevance to emissions to air including concentration limits and deposition rates associated with the previously identified on-site emission sources. These limits ensure ongoing conformance with the specified licence conditions. No specified emission from the installation shall exceed the emission limit values set out in Schedule B, subject to Condition 4, of the licence. There shall also be no other emissions of environmental significance from the site.

Emission limits relating to emissions to air are included in 'Schedule B Emission Limits, Section B.1 Emissions to Air' of IEL P0519-03. These are summarised in Table 9-1, however these limits should be read in conjunction with the licence and are included here for information only.

Table 9-1. Emission Limit Values as per Schedule B, B.1 of IEL P0519-03

Site	Emissions Point	Maximum volume to be emitted	Parameter	Emissions Limit Value
Factory Site	AE-1	Maximum in any one day: 3,240,000 m ³ Maximum rate per hour: 135,000 m ³	Nitrogen Oxide (as NO ₂)	130 mg/m ³ 7.3 kg/hr
			Particulate	50 mg/m ³ 2.8 kg/hr
Factory Site Kettle 6	AE-8	Maximum in any one day: 1,243,176 m ³ Maximum rate per hour: 51,799 m ³	Nitrogen Oxide (as NO ₂)	130 mg/m ³
			Particulate	50 mg/m ³
Factory Site Raymond Mill 5	AE-9	Maximum in any one day: 765,216 m ³ Maximum rate per hour: 31,884 m ³	Nitrogen Oxide (as NO ₂)	130 mg/m ³
			Particulate	50 mg/m ³
Factory Site -Plaster Mill	AE-10	Maximum in any one day: 600,000 m ³ Maximum rate per hour: 25,000 m ³	Nitrogen Oxide (as NO ₂)	50 mg/m ³
			Particulate	20 mg/m ³
Factory Site Board Plant Dryer Exhaust	BE-1	Maximum in any one day: 3,326,400 m ³ Maximum rate per hour: 138,600 m ³	Nitrogen Oxide (as NO ₂)	130 mg/m ³
Factory Site Plaster Mill Calciner Exhausts	BE-4, BE-5, BE-6	Maximum in any one day 141,600 m ³ Maximum rate per hour 5,900 m ³	Nitrogen Oxide (as NO ₂)	200 mg/m ³

Source: < IEL P0519->

The monitoring frequency and control parameters for emissions to air are set out within 'Schedule C Control and Monitoring, Section C.1.1 Control of Emissions to Air and C.1.2 Monitoring of Emissions to Air' of IEL P0519-03. Monitoring frequency varies between continuous to annually dependent on the parameter being measured.

Emission limits relating to dust deposition limits are included in 'Schedule B, Section B.5 Dust Deposition Limit' of IEL P0519-03. These are summarised in Table 9-2, however these limits should be read in conjunction with the licence and are included here for information only. The monitoring locations for dust are included in Volume 3, Appendix A.8.1, Figure A9-1 and Figure A9-2.

Table 9-2. Dust Deposition Limit as per Schedule B, B.5 of IEL P0519-03

Site	Emissions Point	Dust Deposition Limit (mg/m ² /day)*
Mine Site	MS1, MS2, MS3, MS4	350
Factory Site	D1, D2, D3, D4, D5	350

* Applies to a 30 day composite sample with the results expressed as mg/m²/da

Source: < IEL P0519-03 >

The monitoring frequency and control parameters for dust deposition monitoring are set out within 'Schedule C Control and Monitoring, Section C.6 Dust Deposition Monitoring' of IEL P0519-03, which states dust deposition is to be continuously monitored using the VDI 2119 (Bergerhoff method).

9.2.3 Study Area

The study area included the mine and factory sites and considered the monitoring points around both sites specified within IEL P0519-03. The dust monitoring locations are set out by IEL P0519-03. The mine site dust monitoring locations are MS1 to MS4 (see Volume 3, Appendix A.8.1, Figure A9-1) and the factory site dust monitoring locations are D1 to D5 (see Volume 3, Appendix A.8.1, Figure A9-2). Air quality monitoring locations at the factory site are detailed in Table 9-5.

Some stored water is tankered between the mine and factory sites for use at the factory site in factory processes. On a monthly basis there are approximately 4 to 6 loads of water tankered from the mine site to the factory site. It is considered the low traffic volumes associated with this would be not significant from an air quality point of view and on that basis this has not been considered within the defined study area.

9.2.4 Significance / Evaluation Criteria

The Proposed Licence Amendment does not require a detailed air quality assessment and as such a methodology outlining significance and evaluation criteria has not been included with this chapter. Any exceedances of ELV are reported to the EPA by the Applicant and a summary is included in the AER. The ELV implemented for the mine and factory sites which relate to air quality are considered in this chapter.

9.2.5 Limitations in the Methodology and Gaps in Information

The assessment is based upon information produced by others and on information available online such as on the EPA licensing web portal. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the air quality environment within the study area described above and it forms part of the yearly compliance documentation for the EPA. Any information provided by third parties and referred to herein has not been checked or verified by AECOM.

9.3 Description of the Existing Environment

9.3.1 Existing Environment

The mine site includes an operational opencast quarry and underground mines mined for gypsum, an area associated with the primary processing of gypsum which includes a primary and secondary crusher and homogeniser, a Workshop, storage shed, fuel storage, lagoons and the mine office as well as ancillary infrastructure. The lands surrounding the mine site are predominantly agricultural. The factory site includes storage areas for aggregates, rock and waste, and factory buildings such as the board plant and the mill warehouse, as well as an office area. The lands surrounding the factory site are predominately agricultural.

EU legislation as transposed into Irish law under S.I. No. 180/2011 - Air Quality Standards Regulations 2011 requires that Member States divide their territory into zones for the assessment and management of air quality. The zones in place in Ireland are:

- Zone A – Dublin conurbation
- Zone B – Cork conurbation
- Zone C – large towns with a population >15,000, and
- Zone D – the remaining area of Ireland (Rural Ireland).

Both the mine site and the factory site are located within Air Quality Management Zone D²⁶. The Air Quality Index for Health of the region is documented as '2-Good'²⁷.

9.3.1.1 The Mine Site

Dust generating activities at the mine site include, the movement of trucks along haul roads, stripping of overburden, blasting and rock breaking, gypsum extraction, wind erosion at exposed faces (Golder Associates 2017). A list of the dust monitoring locations and the deposition limits as outlined within IEL P0519-03 are presented in Table 9-2, and their locations are described in Table 9-3 (also see Volume 3, Appendix A8.1, Figure A9-1).

9.3.1.2 The Factory Site

Processes at the factory site which result in emissions to air include emissions from processing activities at the factory site in areas such as the plaster mill and at the board plant dryer. Descriptions of monitoring locations monitored in line with IEL P0519-03 are presented in Table 9-1 and Table 9-2. The dust monitoring locations are described in Table 9-4 (also see Volume 3, Appendix A8.1, Figure A9-1).

9.3.2 Sensitive Receptors

A number of monitoring points are specified for both the mine and factory sites within IEL P0519-03. These monitoring points are representative of areas where key operations occur and correlate with potential points of exposure to residential receptors adjacent to the mine and factory sites. The mine site dust monitoring locations are MS1 to MS4 (see Volume 3, Appendix A.8.1, Figure A9-1) and the factory site dust monitoring locations are D1

²⁶ <https://gis.epa.ie/EPAMaps/>

²⁷ <https://gis.epa.ie/EPAMaps/>

to D5 (see Volume 3, Appendix A.8.1, Figure A9-2). Air quality monitoring locations at the factory site are detailed in Table 9-5.

9.3.3 Air Quality Monitoring Locations

A number of dust monitoring locations and air quality emissions locations occur within the mine and factory site. These are listed in Table 9-3, Table 9-4 and Table 9-5.

9.3.3.1 The Mine Site

Table 9-3 Description of the Dust Monitoring Locations at the Mine Site

Monitoring Locations	Description
MS1	Located north of the mine site circa 8- m south of a residential dwelling
MS2	Located northwest of the existing Knocknacran Mine circa 25 m east of a Top Oil garage
MS3	Located east of the mine site
MS4	Located southwest of the mine site at the entrance to the site

9.3.3.2 The Factory Site

Table 9-4 Description of the Dust Monitoring Locations at the Factory Site

Monitoring Locations	Description
D1	Located to the southwest of the factory site next to the R162
D2	Located to the northwest of the factory site next to the entrance off the R162
D3	Located to the southeast of the factory site circa 65 m west of a residential dwelling
D4	Located northeast of the factory site circa 95 m west of a residential dwelling
D5	Located to the west of the R162 next to a residential dwelling circa 50 m west of the main building on the factory site

Information on the exact location of the below monitoring locations was not available at the time of writing, however this information is being provided as baseline only and does not materially affect the consideration of potential impacts of the Proposed Licence Amendment.

Table 9-5 Description of Air Quality Monitoring Locations at the Factory Site

Monitoring Locations	Description
AE-1	No information was available on the exact location of this monitoring location at the time of writing
AE-8	Kettle 6
AE-9	Raymond Mill 5
AE-10	Plaster Mill
BE-1	Board Plant Dryer Exhaust
BE-4	Plaster Mill Calciner Exhausts
BE-5	Plaster Mill Calciner Exhausts
BE-6	Plaster Mill Calciner Exhausts

Source: <IEL P0519-03 >

9.3.4 Baseline Air Quality Information and Monitoring Results

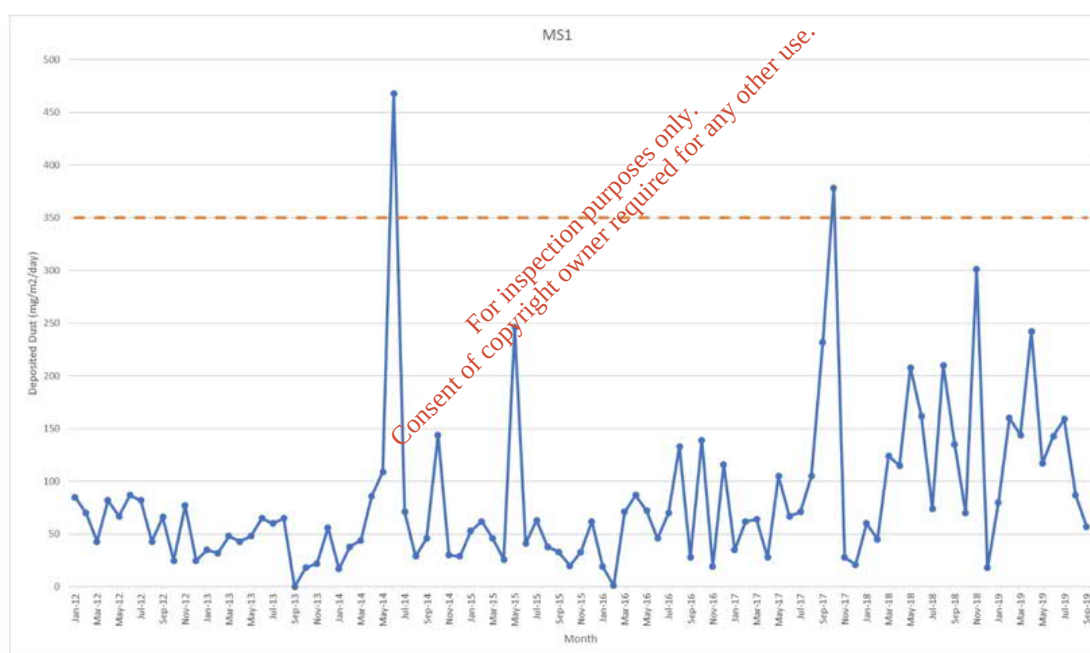
Information on air quality monitoring and monitoring results are based upon the sources outlined in section 8.2.1 and are summarised in the sections below. These sources have been used to inform the baseline air quality environment at the mine and factory site.

9.3.4.1 The Mine Site

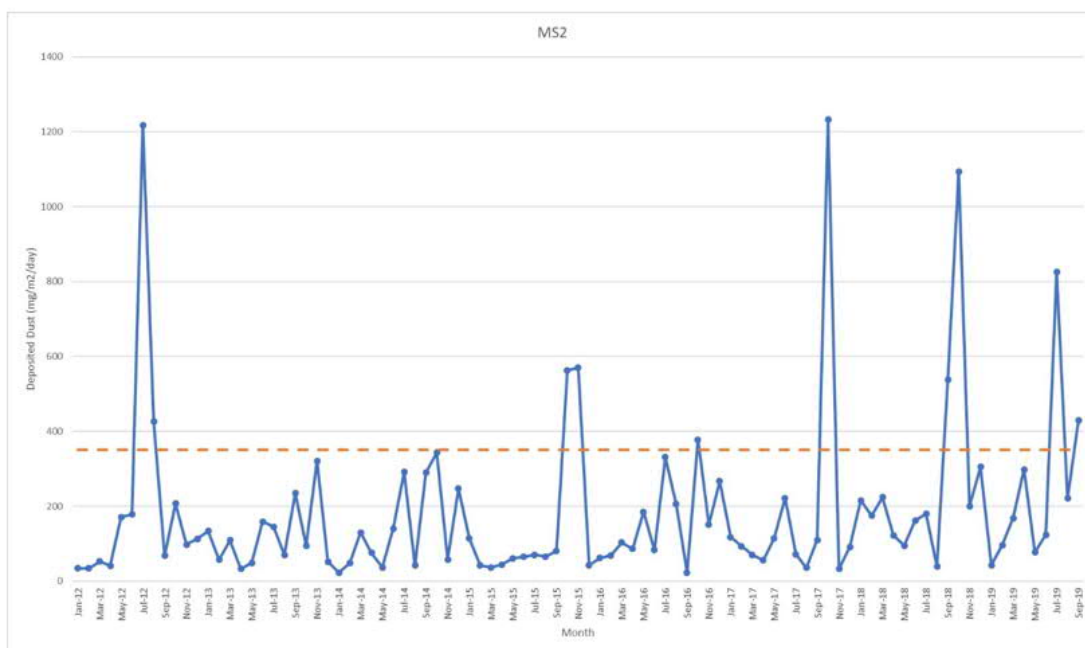
Dust monitoring results provided by the Applicant at the mine site from January 2012 until September 2019 at monitoring locations MS1 to MS4. The assessment identified 26 exceedances of the 350 mg/m²/day limit imposed by IEL P0519-03 within this time, with 93% of samples said to be below the exceedance limit. The greatest concentration identified was 1,232 mg/m²/day recorded in October 2017 at MS2, said to be approximately 3.5 times the dust deposition limit value.

The exceedances were identified to generally be accounted for by organic matter contamination un-associated with mining activities and to adjacent vegetation clearance works at MS2 in July and September 2019. The deposited dust from the existing facility is likely deposited within the site or very close to the site, rather than being carried far off-site. The time series graphs produced by the Applicant for deposited dust recorded at monitoring locations MS1 to MS4 are identified in Graph 9-1 to Graph 9-4.

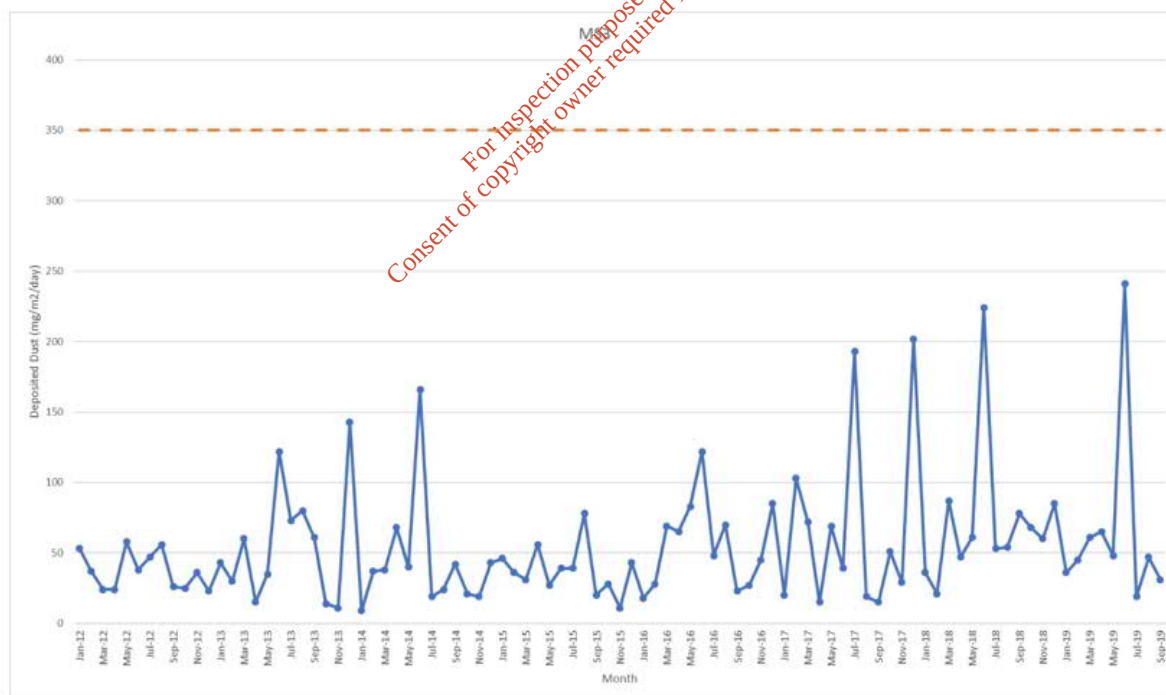
An incident summary of environmental incidents which occurred on site throughout the year of 2019 is included in the AER relating to IEL P0519-03 for the year 2019. Information on dust related incidents are included in Table 9-6.



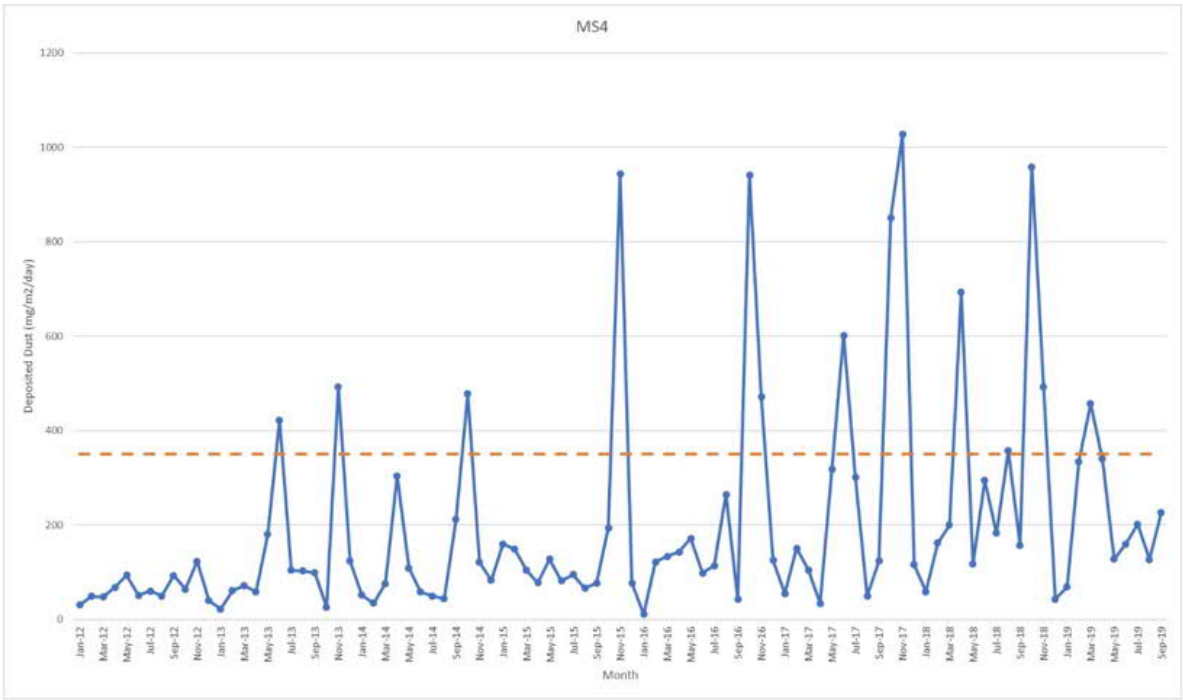
Graph 9-1 Time Series Graph showing Deposited Dust recorded at MS1 (January 2012 - September 2019). Dashed line depicts the ELV for dust of 350 mg/m²/day as outlined within IEL P0519-03. Source: Saint-Gobain Construction Products Ireland Limited (SGCPIL/the Applicant)



Graph 9-2 Time Series Graph showing Deposited Dust recorded at MS2 (January 2012 - September 2019). Dashed line depicts the ELV for dust of 350 mg/m2/day as outlined within IEL P0519-03. Source: the Applicant



Graph 9-3 Time Series Graph showing Deposited Dust recorded at MS3 (January 2012 - September 2019). Dashed line depicts the ELV for dust of 350 mg/m2/day as outlined within IEL P0519-03. Source: the Applicant



Graph 9-4 Time Series Graph showing Deposited Dust recorded at MS4 (January 2012 - September 2019). Dashed line depicts the ELV for dust of 350 mg/m2/day as outlined within IEL P0519-03. Source: the Applicant

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Table 9-6 Summary of Incidents at the Mine Site Based on Information Contained within the 2019 AER.

Date	Incident Nature	Location	Category	Receptor	Cause	Activity at time of incident	occurrence	Corrective Action	Preventative Action	Resolution status and date	Likelihood of reoccurrence
Mine Site											
28/02/2019 00:0	Breach of ELV	MS4	Minor	Air	Operational controls	Normal activities	Recurring	Dust suppression on site - bowing, wheel wash, road sweeping	As per corrective action	Closed 04/06/2019 08:49	Not included in AER for this occurrence
01/09/2019 23:00	Breach of ELV	MS2	Minor	Air	Operational controls	Normal activities	Recurring	Dust suppression on site - bowing, wheel wash, road sweeping	As per corrective action	Closed 21/11/2019 08:14	Medium

Source: <2019 Annual Environmental Report to the EPA>

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9.3.4.2 The Factory Site

Dust monitoring results were not available for the factory site at the time of writing, however this information is provided as baseline information only and does not materially affect the consideration of potential impacts of the Proposed Licence Amendment.

The monitoring results presented within the 2018 and 2019 AER suggest the emissions recorded at the air quality emission points are in compliance with the ELV outlined within IEL P0519-03. Summaries of the results provided within the 2018 and 2019 AER are included in Table 9-7 and Table 9-8. The 2019 AER states that all periodic / non-continuous monitoring was carried out in accordance with EPA guidance note AG2.

The summary of the average emissions (continuous monitoring) at AE-1 for total particulates over an averaging period of 12 months was identified as not breaching the continuous monitoring ELV of 50 mg/m³ within the 2018 AER but was not identified with the 2019 AER²⁸.

Table 9-7 Mass Emissions as Documented within the 2019 AER

Emissions Point	Parameter	Frequency of Monitoring	Emissions Limit Value	Measured Value
AE-1	Total Particulates	Annual	50 mg/m ³	<0.1 mg/m ³
	Nitrogen oxides (NOx/NO2)	Annual	130 mg/m ³	31.3 mg/m ³
	Volumetric flow	Annual	135,000 m ³ /hr	41,339 m ³ /hr
AE-8	Total Particulates	Annual	50 mg/m ³	<0.2 mg/m ³
	Nitrogen oxides (NOx/NO2)	Annual	130 mg/m ³	122.8 mg/m ³
	Volumetric flow	Annual	51799 m ³ /hr	23441 m ³ /hr
AE-9	Total Particulates	Annual	50 mg/m ³	<0.2 mg/m ³
	Nitrogen oxides (NOx/NO2)	Annual	130 mg/m ³	12.2 mg/m ³
	Volumetric flow	Annual	31884 m ³ /hr	20640 m ³ /hr
AE-10	Total Particulates	Annual	20 mg/m ³	<0.2 mg/m ³
	Nitrogen oxides (NOx/NO2)	Annual	50 mg/m ³	6 mg/m ³
	Volumetric flow	Annual	25,000 m ³ /hr	18833 m ³ /hr
BE-1	Nitrogen oxides (NOx/NO2)	Biannual	130 mg/m ³	25.8 mg/m ³
				36.7 mg/m ³
	Volumetric flow	Biannual	138,600 m ³ /hr	65,534 m ³ /hr 30366 m ³ /hr
BE-4	Nitrogen oxides (NOx/NO2)	Annual	200 mg/m ³	68.6 mg/m ³
	Volumetric flow	Annual	5,900 m ³ /hr	1765 m ³ /hr
BE-5	Nitrogen oxides (NOx/NO2)	Annual	200 mg/m ³	77.9 mg/m ³
	Volumetric flow	Annual	5,900 m ³ /hr	7205 m ³ /hr

Source: <2019 Annual Environmental Report to the EPA>

²⁸ It was noted that the unit of measurement on the AER differs to the unit on the licence and that BE-4 was detailed as not compliant within the AER, the reasoning for this was not available at the time of writing, however this information is provided as baseline information only and does not affect the consideration of potential impacts of the Proposed Licence Amendment.

Table 9-8 Mass Emissions as documented within the 2018 AER

Emissions Point	Parameter	Frequency of Monitoring	Emissions Limit Value	Measured Value
AE-1	Total Particulates	Annual	50 mg/m ³	<0.3 mg/m ³
	Nitrogen oxides (NOx/NO ₂)	Annual	130 mg/m ³	26.3 mg/m ³
	Volumetric flow	Annual	135,000 m ³ /hr	44,277 m ³ /hr
AE-8	Total Particulates	Annual	50 mg/m ³	<0.2 mg/m ³
	Nitrogen oxides (NOx/NO ₂)	Annual	130 mg/m ³	70.2 mg/m ³
	Volumetric flow	Annual	51799 m ³ /hr	28660 m ³ /hr
AE-9	Total Particulates	Annual	50 mg/m ³	<0.2 mg/m ³
	Nitrogen oxides (NOx/NO ₂)	Annual	130 mg/m ³	12.5 mg/m ³
	Volumetric flow	Annual	31884 m ³ /hr	19332 m ³ /hr
AE-10	Total Particulates	Annual	20 mg/m ³	15.4 mg/m ³
	Nitrogen oxides (NOx/NO ₂)	Annual	50 mg/m ³	4.5 mg/m ³
	Volumetric flow	Annual	25,000 m ³ /hr	19368 m ³ /hr
BE-1	Nitrogen oxides (NOx/NO ₂)	Biannual	130 mg/m ³	29.4 mg/m ³ 42.3 mg/m ³
	Volumetric flow	Biannual	138,600 m ³ /hr	57,022 m ³ /hr 47047 m ³ /hr
BE-4	Nitrogen oxides (NOx/NO ₂)	Annual	200 mg/m ³	71.4 mg/m ³
	Volumetric flow	Annual	5,900 m ³ /hr	1036 m ³ /hr
BE-5	Nitrogen oxides (NOx/NO ₂)	Annual	200 mg/m ³	108.9 mg/m ³
	Volumetric flow	Annual	5,900 m ³ /hr	6540 m ³ /hr

Source: <2018 Annual Environmental Report to the EPA>

Table 9-9 Summary of Incidents at the Factory Site Based on Information Contained within the 2019 AER.

Date	Incident Nature	Location	Category	Receptor	Cause	Activity at time of incident	occurrence	Corrective Action	Preventative Action	Resolution status and date	Likelihood of reoccurrence
Factory Site											
13/02/2019 00:00	Breach of ELV	D5	Minor	Air	Operational controls	Normal activities	Recurring	Dust suppression on site - bowsing, wheel wash, road sweeping	As per corrective action	Closed 25/02/2019 09:36	Not included in AER for this occurrence

Source: <2019 Annual Environmental Report to the EPA>

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9.4 Assessment of Potential Impacts / Comments on Monitoring Results

The Proposed Licence Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site only. The Proposed Licence Amendment will not require any additional infrastructure to be constructed or any existing infrastructure to be altered. The Proposed Licence Amendment is not required as a result of, or to accommodate an intensification of operations at the site which could give rise to increased emissions. Furthermore the deposition and emission limits as set out in the licence would remain unchanged and the applicant would be required to demonstrate continuous conformance with these. The Applicants existing operations are covered by IEL P0519-03 as issued by the EPA and the mine site and factory site will continue to operate to the dust deposition limits and monitoring requirements for air quality as set out within IEL P0519-03.

9.4.1 The Mine Site and The Factory Site

Dust monitoring results provided by the Applicant for the mine site based on information from January 2012 until September 2019 identified 26 exceedances of the 350 mg/m²/day limit imposed by IEL P0519-03 within this time with 93% of samples said to be below the exceedance limit. The exceedances were identified to generally be accounted for by organic matter contamination un-associated with mining activities and at MS2 in July and September 2019 to adjacent vegetation clearance works. The deposited dust from the existing facility is likely deposited within the site or very close to the site, rather than being carried far off-site. The incident summary contained within the 2019 AER identified three occasions within 2019 where a breach of the ELV occurred, two at the mine and one at the factory site, all incidents were reported to be minor.

The monitoring results presented within the 2018 and 2019 AER as outlined in Table 9-7 and Table 9-8 suggest the emissions recorded at the air quality emission points are in compliance with the ELV outlined within IEL P0519-03.

Although some air quality related exceedances have occurred the Proposed Licence Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site only and this will not impact upon the existing air quality procedures or emissions on site. As the Proposed Licence Amendment will not require any additional infrastructure to be built, any existing infrastructure to be updated or any change to ELV for air quality as set out within IEL P0519-03. No impacts outside of that licenced under IEL P0519-03 are anticipated for air quality.

9.5 Cumulative Impacts

The Proposed Licence Amendment will not require any additional infrastructure to be constructed or any existing infrastructure to be altered. The Proposed Licence Amendment is not required as a result of, or to accommodate an intensification of operations at the site which could give rise to increased emissions. Furthermore the deposition and emission limits as set out in the licence would remain unchanged and the applicant would be required to demonstrate continuous conformance with these. The Proposed Licence Amendment does not look to alter any air quality emissions limits or monitoring requirements as outlined within IEL P0519-03. No impacts outside of that licenced under IEL P0519-03 are anticipated for air quality. As such no potential for cumulative impacts from the Proposed Licence Amendment were identified for air quality.

9.6 Mitigation Measures

No requirement for mitigation measures as a result of the Proposed Licence Amendment has been identified. The mitigation measure below are provided for information only and relate to existing measures currently in place on the mine and factory sites which are required to manage the day to day site operations. These measures would be unaffected by the Proposed Licence Amendment.

Mitigation measures currently employed on site are those set out within IEL P0519-03. A number of additional mitigation measures have also been outlined in previous EIAR for the mine such as the EIAR prepared by Golder Associates (2017). The mitigation outlined within the Golder Associates 2017 EIAR include:

- The timing of operations will be optimised in relation to meteorological conditions
- Material is generally moved from the open-pit floor to the process areas. Should outdoor stockpiling be necessary these will be conditioned with water to minimise dust during dry and windy conditions. In addition, stockpiles will be sited to take advantage of shelter from wind
- Overburden mounds will be grass-seeded and planted to eliminate wind-blown dust
- Plant will be regularly maintained
- Internal haul roads will be compacted and maintained
- A water bowser/sprayer will be available at all times to minimise dust during dry and windy conditions where it is impractical or inappropriate to operate a fixed water spray/sprinkler system
- On site speed restrictions (<25 kph) will be maintained in order to limit the generation of fugitive dust emissions
- All vehicles exiting the mine site will exit through the existing wheel wash, and
- All vehicles carrying fine dry loads will be covered prior to exiting the mine site.

All measures within the EMP for the mine and factory sites will continue to be adhered to in line with the requirements of the EMP and the IEL.

This Proposed Licence Amendment does not look to alter any of the air quality related limits or monitoring requirements within the existing IEL P0519-03. Monitoring required under IEL P0519-03 has shown the mine and factory sites are predominantly compliant with the limits set out in IEL P0519-03. In light of this additional mitigation measures have not been proposed as part of this EIAR, however all previous mitigation as outlined within previous EIAR should be adhered to as well as all air quality related limits and monitoring requirements outlined within the existing IEL P0519-03.

9.7 Residual Impacts

No residual impacts were identified.

9.8 Summary

Dust monitoring results for the mine site based on information from January 2012 until September 2019 identified 26 exceedances of the 350 mg/m²/day limit imposed by IEL P0519-03 within this time with 93% of samples said to be below the exceedance limit. Exceedances were identified to generally be accounted for by organic matter contamination un-associated with mining activities and at MS2 in July and September 2019 to adjacent vegetation clearance works. The deposited dust from the existing facility is likely deposited within the site or very close to the site, rather than being carried far off-site. The incident summary contained within the 2019 AER identified three occasions within 2019 where a breach of the ELV occurred, all incidents were reported to be minor. The air quality monitoring results presented within the 2018 and 2019 AER as outlined in Table 9-7 and Table 9-8 suggest the emissions recorded at the air quality emission points are in compliance with the ELV outlined within IEL P0519-03.

No potential for cumulative impacts from the Proposed Licence Amendment and no additional mitigation measures were identified for air quality.

The Proposed Licence Amendment relates to an increase in the ELV for sulphate at Compliance Point CP-1 from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm. No additional infrastructure or upgrade of existing infrastructure is required to facilitate the Proposed Licence Amendment. The Proposed Licence Amendment does not look to alter any of the air quality related limits or monitoring requirements within the existing IEL P0519-03. The Proposed Licence Amendment will not alter the existing air environment or introduce a new air related emissions source.

10 Climate

10.1 Introduction

As set out in the 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' August 2018 (DHPLG 2018), the EIA Directive requires the assessment of impact upon climate (e.g. greenhouse emissions) and vulnerability of the project to climate change. In respect of the Proposed Licence Amendment ('the project'), there are generally two key aspects considered within this chapter:

- Climate change mitigation – impact of the operations of the mine and factory site as a consequence of the Proposed Licence Amendment upon climate change, primarily through greenhouse gas emissions (direct and indirect), and
- Climate change adaptation – vulnerability of operations of the mine and factory site as a consequence of the Proposed Licence Amendment to future changes in climate and its capacity to adapt to the impacts of climate change.

With reference to the 'Guide Book for Evaluating Mining Project EIA's' (Environmental Law Alliance Worldwide, 2010), there are many phases to the life cycle of a mining project, from exploration through to the post-closure period, all of which are associated with a range of different environmental impacts. In terms of climate change, every EIA for a project that has the potential to change carbon budgets should include an assessment of a project's carbon impact. Large-scale mining projects typically have the potential to alter carbon budgets in the following ways:

- Lost carbon dioxide (CO₂) uptake by forests, woodland and vegetation that is cleared to accommodate the mine and any other associated infrastructure to facilitate the operation
- CO₂ emitted by plant and machinery (e.g., diesel-powered heavy vehicles) involved in extracting and transporting mineral gypsum; Typically, an EIA should include a quantitative estimate of CO₂ emissions from plant, machines and vehicles that will be needed during the life cycle of the mining project. These estimates can be based on the rate of fuel consumption (typically diesel fuel) multiplied by a conversion factor that relates units (typically litres or gallons) of fuel that is consumed and units (typically metric tons) of CO₂ that is emitted, and
- CO₂ emitted by the processing of the gypsum ore into plaster (i.e. plasterboard) through calcination (i.e. as a consequence of the operations undertaken at the factory site).

As set out in Chapter 1 (Introduction) of this EIAR, activities at the mine and factory sites currently operate under licence for the extraction and processing (including size reduction, grading and heating) of mineral within the meaning of the Minerals Development Acts 1940 to 1999, where an activity involves any other operation where either the level of extracted or processed mineral is greater than 200,000 tonnes per annum or the total operation yield is greater than 1,000,000 tonnes and storage of related mineral waste.

Further information on the processes carried out at the mine and factory sites are detailed in Chapter 3 Project Description, Section 3.2.

Both activities are licenced under IEL P0519-03, however, as a consequence of a recent alteration in the existing water management procedures at the mine site, a review of the licensing conditions is being sought, further information on the need for the Proposed Licence Amendment is included in Chapter 1 Introduction, Section 1.1 and 1.2.

10.2 Methodology

This climate assessment has been prepared in accordance with, and informed by the following guidance:

- 'Guidelines on the Information to be contained in Environmental Impact Statements' (2002), Environmental Protection Agency (EPA) (EPA 2002)
- 'Advice Notes on Current Practice (in preparation of Environmental Impact Statements)' (2003), EPA (EPA 2003)

- 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (DRAFT 2017), EPA (EPA 2017)
- 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (2018) Government of Ireland
- 'Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation' (2020), Institute of Environmental Management and Assessment (IEMA) (IEMA 2020), and
- 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance' (2017), IEMA (IEMA 2017).

In line with IEMA guidance, consideration has been given within this EIA to the following aspects of climate change assessment:

- Lifecycle greenhouse gas (GHG) impact assessment – the impact of GHG emissions arising as a consequence of the Proposed Licence Amendment and subsequent operational changes on the climate during the lifecycle stages
- Climate change resilience (CCR) review – the resilience of the Proposed Licence Amendment and subsequent operational changes to projected climate change impacts, and
- In-combination climate change impact (ICCI) assessment – the combined impact of the Proposed Licence Amendment and subsequent operational changes and future climate change on receptors in the surrounding environment.

10.2.1 Lifecycle Greenhouse Gas Impact Assessment

In line with IEMA guidance, a good practice approach to EIA requires that GHG emissions are scoped into the assessment and thus estimated, reported and mitigated as part of the project's undertakings as necessary. This approach is followed for all projects regardless of whether there is a net increase or decrease in GHG emissions relating to the works.

There are many different assessment methods available for measuring and quantifying the GHG emissions associated with the built environment. These range from general guidance to formal standards and many will be appropriate for use in EIA depending on the goals and scope of the assessment required.

In terms of the assessment, and in particular, proportionality, it is acknowledged within Sections 10.3 and 10.4 of this chapter that the operations associated with the mine and factory site are a contributor to GHG emissions and accordingly, are regulated under the EU Emissions Trading System (ETS). However, what is proposed (i.e. the licence review to alter the water management procedures and discharge conditions from the site) would have little impact to, or consequence upon the lifecycle operation of the gypsum mining and manufacturing process at Kingscourt. On this basis, a high-level qualitative assessment of GHG has been undertaken for the project, in light of no measurable expected change to the lifecycle process and consequential emissions output.

10.2.2 Climate Change Resilience Review

In line with the IEMA guidance, the vulnerability of the Proposed Licence Amendment to climate change has been considered. A high-level review of climate change resilience for the Proposed Licence Amendment has been conducted which identifies potential climate change impacts.

The review has included all infrastructure and assets associated with the Proposed Licence Amendment. It covers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events.

10.2.3 In-combination Climate Change Impact (ICCI) Assessment

The ICCI assessment has not been included in the climate chapter. The rationale for scoping out this assessment, is summarised in Table 10-1.

Table 10-1 Rationale for scoping out climate parameters for the ICCI assessment

Parameter	Rationale for scoping out
Extreme weather	The impacts of extreme weather events on the water environment discipline are considered as part of the climate change allowances within the Chapter 8: Water (Hydrology and Hydrogeology) and it would not be proportionate or appropriate to assess such effects within the EIAR solely for the purpose of the ICCI assessment. These impacts have therefore not been included in this chapter.
Sea level rise	The site is not located in an area that is susceptible to sea level rise.
Temperature	The site is within a rural area, and as such would have no heat urban island effect when considering location and operations.
Precipitation	The impact of increased rainfall due to climate change is considered as part of the Chapter 8: Water (Hydrology and Hydrogeology). It is therefore not considered proportionate or appropriate to assess precipitation within this chapter solely for the purposes of the ICCI assessment.
Wind	It is not proportionate to assess wind solely for the purposes of the ICCI assessment due to a lack of wind climate projections.

10.2.4 Classification of Significance of Effects

There are no specific criteria for determining the significance of GHG emissions for EIAR. The IEMA guidance (IEMA 2017) on GHG in EIAR states that 'any GHG emissions or reductions from a project might be considered to be significant'. As such, the National Emissions Inventories for Ireland (EPA 2019a), as compiled by the EPA, have been used as a proxy for the level of effect of GHG emissions as a result of the Proposed Licence Amendment on the global climate. Consideration has also been given to the mineral sector within the National Emissions Inventories for Ireland (2019) to further contextualise the impact of GHG emissions. Additional GHG emissions as a result of the Proposed Licence Amendment have also been considered in the context of Ireland's carbon reduction targets and the impact, they may have on these targets being achieved.

In GHG accounting it is common practice to consider exclusion of emission sources that are <1% of a given emissions inventory on the basis of a 'de minimis' contribution. The Publicly Available Specification (PAS) 2050 - Carbon Footprint (British Standards Institute (BSI), 2011) Specification allows emissions sources of <1% contribution to be excluded from emission inventories, and these inventories to still be considered complete for verification purposes. This would therefore suggest that a development with emissions of <1% of Ireland's national inventory would be minimal in its contribution to the wider national GHG emissions.

To put the impact from estimated annual GHG emissions from the project into further context a reporting threshold of 25,000tCO₂e per annum used by the International Finance Corporation (IFC) (2011) for projects that it contributes funding to has also been used to determine the magnitude of the impact. Therefore, emissions of <25,000 tCO₂e as a result of a development might also be of low magnitude.

In the absence of specific criteria for defining the significance of GHG emissions, the IEMA guidance suggests that professional judgement should be used to contextualise the GHG impact. The approaches outlined above have been adopted to assess the magnitude of the GHG impact associated with the Proposed Licence Amendment and the associated criteria are outlined in Table 10-2.

Table 10-2: Magnitude Criteria for the Lifecycle GHG Impact Assessment

Magnitude	Magnitude criteria
High	Annual GHG emissions represent equal to or more than 1% of the relevant annual National Carbon Budget or are more than 25,000 tCO ₂ e in any year.
Low	Annual GHG emissions represent less than 1% of the relevant annual National Carbon Budget and are less than 25,000 tCO ₂ e in any year.

10.2.5 Limitations in the Methodology and Gaps in Information

No significant data gaps or limitations were encountered as part of this assessment.

10.3 Legislation and Guidance

This sub-section provides details of the legislation and guidance that is pertinent to the assessment of climate change impacts in the context of operations that take place at the mine and factory site, and in particular, as a consequence of the Proposed Licence Amendment.

10.3.1 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994, and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012. The Kyoto Protocol (WRI, 2012) was amended in 2012 to include a 7th mandatory GHG (nitrogen trifluoride; NF₃).

According to the 'Ireland's Greenhouse Gas Emission Projections 2012-2030' (EPA, 2013) report, Ireland was on track to meet its commitment under the Kyoto Protocol. This is in marked contrast to the projection in Ireland's 2007 National Climate Change Strategy which forecast a total distance to target of 18M tonnes of CO₂e. The reason Ireland was on track was primarily as a direct result of economic recession and economic outlook for the future at that time.

In light of the Kyoto Protocol, the EU ETS was established in January 2005 and required European countries to reduce GHG emissions on average by 8% by 2012 compared with 1990 levels (UNFCCC, 1997). The EU ETS is the world's largest market for emissions permits covering 45% of EU GHG emissions from 11,000 installations in power generation and heavy industry.

In December 2015, at a meeting of the UNFCCC in Paris, a new global agreement (called the Paris Agreement) was reached to address climate change (UN, 2015). Entering into force in 2020, the agreement aims to:

- Hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C
- Increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development in a manner that does not threaten food production, and
- Make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

With reference to the EPA's 'Ireland's Environment – An Assessment 2016' (EPA, 2016) to achieve this, GHG emissions must peak as soon as possible and then be reduced rapidly in order "to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century".

The Agreement establishes a long-term adaptation goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the 2°C temperature goal". This makes it clear that, if mitigation activities succeed in limiting the rise in global temperature, less adaptation will be needed.

The Paris Agreement will measure the effectiveness of Nationally Determined Contributions (NDCs) in achieving the goals of the Agreement via a series of global stocktakes, to be held in five-yearly cycles beginning in 2023. Ireland's contribution to the Paris Agreement will be via the NDC tabled by the EU on behalf of its Member States, which commits the EU as a whole to reduce greenhouse gas emissions by at least 40% by 2030, compared with 1990 levels. To meet their obligations, European Member States divide their emissions into two categories:

- Those included in the EU ETS, which predominantly covers energy producers and various other heavy industrial emitters (which includes the mine and factory site at Kingscourt), and
- Those not included in the scheme (non-ETS), which covers all other sources of GHG emissions.

In terms of EU Emission Targets, the remainder of this chapter focuses primarily on those covered by the EU ETS.

10.3.2 EU Emissions Trading System (ETS) Directive (2003/87/EC)

Directive 2003/87/EC of the European Parliament and of the Council of 13th October 2003 established a scheme for greenhouse gas emission allowance trading within the community and amending Council Directive 96/61/E. The gypsum industry is explicitly included in the amended EU ETS Directive as:

“Drying or calcination of gypsum or production of plaster boards and other gypsum products, where combustion units with a total rated thermal input exceeding 20 MW are operated.”

As detailed within the Climate Change section of the Environmental Protection Agency (EPA) webpage²⁹, the EU ETS is a cornerstone of the EU's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. The first, and still by far the biggest international system for trading greenhouse gas emission allowances, and as noted previously, the EU ETS covers more than 11,000 power stations and industrial plants in 31 countries, including the Kingscourt Works (which is the installation name associated with the EPA Greenhouse Gas Emissions Permit). The installation relates to any stationary technical unit associated with the mining and manufacturing site where one or more activities listed in Schedule 1 to the Regulations are carried out. Also any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution.

The EU ETS was launched in 2005 as the world's first international company-level 'cap-and trade' system for reducing emissions of greenhouse gases cost-effectively. The EU ETS is established under Directive 2003/87/EC and amendments. This is implemented in Ireland under S.I. 490 of 2012 and amendments and S.I. No. 261 of 2010 and amendments. The scheme is being implemented in distinct phases or 'trading periods'.

The overall EU objective for 2020, adopted by the European Council in March 2007, is to reduce its greenhouse gas emissions by 20% by 2020 compared to 1990 levels. This is to be achieved through reductions in all sectors of the economy. Reductions through the EU's ETS are complemented by the individual targets for each EU Member State, established through the 2009 Effort Sharing Decision.

The legislative framework of the EU ETS was revised in 2018 to enable it to achieve the EU's 2030 emission reduction targets in line with the 2030 climate and energy policy framework and as part of the EU's contribution to the 2015 Paris Agreement.

10.3.2.1 Emissions Trading

Emissions' trading is a market-based system to reduce the emissions of climate-damaging greenhouse gases. It is based on the principle of a 'Cap and Trade' system: The cap makes sure that CO₂ becomes a product and, thus, CO₂ is valued at a price, which is determined by the supply and demand at the (trading) market.

To the installations (such as the Kingscourt Works), which have to be part of emissions trading scheme according to the legislation, a defined number of emission allowances (from the cap) are allocated. The allocation rules are defined Europe-wide. One emission allowance equals one tonne of CO₂.

Once a year, each installation has to surrender enough allowances to cover all its emissions. If a company reduces its emissions so that it has more allowances than it needs, it can sell the remaining (not needed) allowances at the market. Alternatively, it has to purchase additional allowances to comply with its surrender obligation. If a company does not fulfil its obligations to surrender allowances in line with their verified emissions / tonnes of CO₂, heavy penalties will apply.

Those facing difficulty in remaining within their allowance limit have a choice between several options:

- They can take measures to reduce their emissions (such as investing in more efficient technology or using a less carbon intensive energy source)
- They can buy extra allowances and / or Clean Development Mechanism (CDM) / Joint Implementation (JI) instrument credits on the market (the EU ETS links to emission reduction opportunities in the rest of the world by accepting credits from emission-saving projects carried out under the Kyoto Protocol's CDM and JI), or
- They can use a combination of the two. This flexibility ensures that emissions are reduced in the most cost-effective way.

²⁹ <http://www.epa.ie/climate/emissionstradingoverview/>

The fundamental objective of the scheme is to initiate a structural change in power generation assets away from carbon intense generation.

The scheme consists of consecutive phases each with increasing GHG emission constraints. The scheme is now in its third phase, which runs from 1 January 2013 to 31 December 2020. However, allowances are valid for the entire phase and surpluses can be carried forward or “banked” beyond 2020. Reform of the EU ETS has been agreed for Phase IV, commencing in 2021. The rate of the cap annual reduction factor will be increased from 1.74% to 2.2% per year until 2030.

10.3.2.2 Emissions Trading Scheme - Stationary Installations

Across the EU and three European Economic Area (EEA) - European Free Trade Association (EFTA) states, some 11,000 heavy energy consuming installations in power generation and manufacturing are covered (as mentioned previously). The system covers emissions of CO₂ from power and heat generation and a wide range of energy-intensive industry sectors including oil refineries, steel works and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals. Nitrous oxide emissions from the production of certain acids and emissions of perfluorocarbons from aluminium production are also included. In Ireland approximately 100 installations are covered by the scheme, including:

- Saint-Gobain Construction Products (Ire) Ltd: Kingscourt Works (IE-GHG002-10335-4)

Background information regarding the ETS, and in particular, the Greenhouse Gas Emissions Permit for the Kingscourt works are detailed further in Sub-Section 10.3 (Description of the Existing Environment) of this chapter.

10.3.3 National Climate Legislation & Policy

As set out in the National Climate Policy section of the Department of Communications Climate Action & Environment webpage³⁰, the extent of the challenge to reduce GHG emissions in line with International and EU obligations is reflected in the National Policy Position on Climate Action and Low Carbon Development (2014) (DCCAE 2014). and the Climate Action and Low Carbon Development Act 2015 (Government of Ireland 2015). Both the policy position and legal framework are key elements of the effort to progress the national low carbon transition agenda in Ireland.

The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective; clarifies the level of GHG mitigation ambition envisaged; and establishes the process to pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- An aggregate reduction in CO₂ emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors, and
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

The evolution of climate policy in Ireland will be an iterative process based on the adoption by Government of a series of national plans over the period to 2050. Greenhouse gas mitigation and adaptation to the impacts of climate change are to be addressed in parallel national plans – respectively through National Mitigation Plans and National Climate Change Adaptation Frameworks. The plans will be continually updated, as well as being reviewed on a structured basis at appropriate intervals, and at a minimum, every five years. This will include early identification and ongoing updating of possible transition pathways to 2050 to inform sectoral strategic choices.

10.3.3.1 Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act 2015 (Government of Ireland, 2015) provides a statutory basis for the national objective of transition to a low-carbon, climate-resilient and environmentally sustainable economy by the year 2050 and gives a solid statutory foundation to the institutional arrangements necessary to enable the State to pursue GHG emission mitigation and climate change adaptation measures. As provided for in the 2015 Act, in order to pursue and achieve the national transition objective, the Minister for Communications, Climate Action and Environment must make and submit to Government a series of successive National Mitigation Plans (NMPs) and National Adaptation Frameworks (NAFs). When considering these plans and frameworks,

³⁰ <https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-at-a-national-level/Pages/default.aspx>

Government must ensure that the national transition objective is achieved by the implementation of measures that are cost-effective.

10.3.3.1.1 National Mitigation Plan (July 2017)

The first NMP represented an initial step to set Ireland on a pathway to achieve the level of decarbonisation required. It is a whole-of-Government Plan, reflecting in particular the central roles of the key Ministers responsible for the sectors covered by the Plan – Electricity Generation, the Built Environment, Transport and Agriculture, as well as drawing on the perspectives and responsibilities of a range of other Government Departments.

The measures implemented through this first Plan were intended to lay the foundations for transitioning Ireland to a low carbon, climate resilient and environmentally sustainable economy by 2050. To support this ongoing work, the Plan also included over 100 individual actions for various Ministers and public bodies to take forward.

Importantly, the Government recognised that this first Plan did not provide a complete roadmap to achieve the 2050 objective, but began the process of development of medium to long term mitigation choices for the next and future decades. However in a landmark Supreme Court judgment given on 31st July 2020, the NMP was quashed due to non-compliance with the Climate Action and Low Carbon Development Act, 2015 (the “Act”). The Plan did not contain the specificity required for appropriate transparency in order to comply with the Act. This means the government will now need to pass a new Mitigation Plan in compliance with the Act. This new plan needs to have appropriate specificity to ensure that Ireland can meet the objective of transitioning to a low carbon climate resilient and environmentally sustainable economy by the end of 2050. There is currently no replacement NMP.

10.3.3.1.2 National Adaptation Framework (January 2018)

The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The NAF was developed under the Climate Action and Low Carbon Development Act 2015.

The NAF builds on the work already carried out under the National Climate Change Adaptation Framework (NCCAF, 2012). The NAF outlines a whole of government and society approach to climate adaptation in Ireland. Under the NAF a number of Government Departments will be required to prepare sectoral adaptation plans in relation to a priority area that they are responsible for. Work on these plans will begin in 2018. Local authorities are required to prepare local adaptation strategies. The NAF will be reviewed at least once every five years. The NAF also aims to improve the enabling environment for adaptation through ongoing engagement with civil society, the private sector and the research community.

10.3.3.2 Climate Action Plan 2019 – To Tackle Climate Breakdown

The objective of the Climate Action Plan (CAP) (Government of Ireland, 2019b) is to enable Ireland to meet its EU targets to reduce its carbon emissions by 30 per cent between 2021 and 2030 and lay the foundations for achieving net zero carbon emissions by 2050. The Plan outlines 180 actions that need to be taken across all the key sectors. The CAP will be updated every 12 months.

Targets also include developing coherent reduction strategies for waste and resource use, and increasing the level and quantity of recycling, with less contamination and greater replacement of virgin materials.

In addition to reducing GHG emissions, the CAP also highlights the importance of considering future climate change, such as increases in severe weather events and increased incidence of flooding, and building climate change resilience into new development.

As part of the plan, a detailed sectoral roadmap has been set out, which is designed to deliver a cumulative reduction in emissions, over the period 2021 to 2030, of 58.4 MtCO₂eq. outside the ETS, 17 MtCO₂eq. within the ETS, and 26.8 MtCO₂eq. from land use.

Whilst the CAP predominantly focuses on the non-ETS sector, it does set measures to deliver targets within the ETS sector as follows:

- A strong carbon price signal, as part of a reformed ETS post-2020, including progressively more restrictive rules on how many allowances will be available within the ETS, is expected to drive decarbonisation over the coming decade by increasing the cost to firms in the ETS of doing nothing to reduce their emissions. The Irish Government is committed to continuing to work proactively with EU partners, including considering the need for further reforms to the ETS or for supplementary measures, so that the ETS can effectively deliver reductions in greenhouse gas emissions, while addressing the challenges faced by sectors most exposed to international competition, and

- Within the ETS sector, Marginal Abatement Cost Curve (MACC) analysis has identified potential for significant cost-effective abatement, in particular in the cement sector from substituting fossil fuels in combustion for non-fossil fuel alternatives, including from different waste streams, and in the food and drink sector through meeting low-temperature heat requirements with low-carbon sources. The cement sector, in particular, has taken steps in this direction, with plans to accelerate fuel substitution activities in the future. The Irish Government will work with such sectors to identify any additional measures that could support them in achieving emissions abatement over the coming decade.

10.3.4 Saint Gobain Company Policy

10.3.4.1 Climate Change

By 2025, the Applicant has committed to reducing CO₂ emissions by 20%, non-recovered waste by 50%, and industrial water emissions by 80% (base 2010). They have also committed to reach net-zero emissions by 2050 in line with 1.5°C scenarios.

The Applicant's ambition is to guarantee the preservation of the environment and to offer its customers the greatest added value with the minimum environmental impact. The Applicant has therefore set two objectives: zero environmental accidents and the minimisation of their activities' impact on environment due to actions on five priorities as follows:

- A policy of sustainable resource management with minimal production waste, reuse, and integration of maximum recycled content into their products
- A reduction in energy consumption and greenhouse gas emissions of their industrial processes, infrastructure and transport, due to industrial excellence programs (WCM), the involvement of all operators, the sharing of best practices, etc
- A reduction in water withdrawals to move towards "zero discharge" of industrial water, starting with areas of water stress and ensuring that it does not interfere with the local population's access to drinking water
- Preserve, restore, strengthen and enhance the biodiversity of all of their sites, and
- Anticipate and deal with risk factors related to environmental accidents and nuisances.

Faced with climate change and the risks posed by rising temperatures, the Applicant acknowledges their responsibility to promote the emergence of a low-carbon economy capable of preserving the common good.

This starts with providing a response directly in their core businesses, by developing products and solutions that promote energy efficiency and reduce CO₂ emissions. To this end, the Applicant's dedicated R&D program coordinates and amplifies efforts to improve manufacturing methods. An internal carbon price has been introduced to encourage the use of these low-carbon technologies.

10.3.4.2 Circular Economy

Through their ability to constantly rethink the way they design, produce and distribute, the Applicant is also working for a successful transformation towards circular economy. This includes upgrading products and solutions to help the integration of recycled or renewable materials, extend their lifespan, and facilitate their recycling or reuse. The Applicant integrates eco-innovation principles right from the conception of their products in order to further progress towards their objective: zero non-recovered waste. This approach includes:

- Improve their products and solutions to promote the integration of recycled or renewable materials, extend their lifespan and facilitate their recycling or reuse
- Develop their manufacturing processes, with the objective of moving towards zero non-recovered waste, and
- Work with stakeholders to change society through collective initiatives in which they participate

Key indicators of change within this sector include:

- Reduction in the withdrawals of virgin raw materials in avoided tons, and
- Reduction of 50% of non-recovered waste by 2025 (base 2010).

10.4 Description of the Existing Environment

10.4.1 Greenhouse Gas Emissions – The Current Situation

With reference to the CAP (2019), latest projections indicate that a strong surge in demand for electricity, at a rate faster than the introduction of renewables, will mean Ireland's ETS sector emissions will continue to increase up to 2025, after which point policies contributing to fuel switching in power generation will contribute towards stronger emissions reduction to the end of the decade. While annual emission limits for the period 2021 to 2030 will guide Ireland towards the 2030 target, the main binding target will be for cumulative emissions.

With reference to the EPA webpage³¹, Ireland's final greenhouse gas emissions are estimated to be 60.93 million tonnes carbon dioxide equivalent (Mt CO₂eq) in 2018, which is 0.1% lower (or 0.07 Mt CO₂eq) than emissions in 2017 (61.00 Mt CO₂eq) and follows a 1.0% decrease in emissions reported for 2017. Emissions reductions have been recorded in 7 of the last 10 years. In the last 2 years national total emissions have only decreased by 0.9% or 0.56 Mt CO₂eq, following very large increases of over 3.5% in both 2015 and 2016. In the same period, emissions in the stationary ETS sector (which covers the Kingscourt works) have decreased by 12.9% or 2.22 Mt CO₂eq whereas emissions under the ESD (Effort Sharing Decision) increased by 3.7% or 1.6 Mt CO₂eq.

Ireland's greenhouse gas emissions decreased by 0.1% (0.07 Mt CO₂eq) in 2018 compared to 2017 with decreases observed in only 3 sectors including:

- Energy Industries emissions decreased by 10.7%
- Waste emissions have decreased by 3.2%, and
- F-Gases emissions have decreased by 11.9%.

Emissions trends are heading in the wrong direction in the following sectors in 2018, compared to 2017 emissions:

- Agriculture with an increase of 1.9%
- Transport up 1.6%
- Residential up 7.9%;
- Manufacturing Combustion up 3.9%
- Industrial processes up by 2.0%, and
- Commercial and Public services both increased by 5.3% and 8.2% respectively.

These increases in emissions makes achievement of Ireland's long-term decarbonisation goals ever more difficult. Arresting this growth is a challenge in the context of a growing economy but one which must be addressed by households, business, farmers and communities if Ireland is to reap the benefits of a low-carbon economy.

10.4.1.1 Manufacturing Combustion

Manufacturing Combustion sector was responsible for 7.8% of Ireland's total GHG emissions in 2018. Emissions from the combustion of fuels in manufacturing increased by 3.9% or 0.18 Mt CO₂eq in 2018 compared to 2017 emissions. There were increases in combustion emissions for all sub sectors including cement which increased by 5.8% in 2018. Increased emissions from companies within the ETS were evident in the chemicals, food and drink and cement sectors, with emissions increasing by 1.0%, 0.9% and 5.8% respectively.

The latest projections (July 2020) show that under the With Existing Measures scenario, emissions from manufacturing combustion are projected to increase by 28.3% between 2019 and 2030 to 6 Mt CO₂eq.

Under the With Additional Measures scenario, emissions from manufacturing combustion are projected to increase by 6.5% between 2019 and 2030 to 5 Mt CO₂eq.

With reference to 'Ireland's National Inventory Report 2019 – Greenhouse Gas Emissions 1990 – 2017' (EPA 2019b) EPA, in terms of emissions from the mineral industry, cement has been identified as a key producer of CO₂. The inventory does not identify mineral gypsum as a key producer of CO₂ which is perhaps indicative, that the Kingscourt Works (as described below) has been identified as an installation that satisfies the criteria for

³¹ <http://www.epa.ie/ghg/currentsituation/>

installations with low emissions (as defined by Article 47 of The Monitoring and Reporting Regulation (MRR) (Commission Regulation (EU) No 601/2012)).

10.4.1.2 The Kingscourt Works

The mineral gypsum is calcium sulphate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) from a chemical point of view. The production process starts with the mining of the mineral, which is then ground to a powder. This powder can be sold as a component to cement.

Inside the gypsum production process, the powder is dried until a water content of 0.5% is reached. The resulting raw gypsum can be sold as a soil conditioner, then called land plaster. If the raw gypsum is heated ("calcined") at 150°C to 165°C, three-quarters of its combined water is removed to produce hemi-hydrate plaster ($\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$), commonly known as stucco or 'Plaster of Paris'. When this powder is mixed with water the resulting paste sets hard as the water recombines to produce gypsum again. Higher calcination temperatures produce so-called anhydrite, which has a lower reaction with water. (EU ETS DOC).

In a last production step, the plaster can be mixed with water and other components (additives, accelerators, etc.) to produce gypsum blocks, or, if pressed between two sheets of paper, plasterboard. gypsum reinforced with glass-fibre (Glass Reinforced Gypsum – GRG) is used to increase its fire-resistance. These processes take place at the Kingscourt Works (which encompasses both the Mine and Factory site).

Emissions in the gypsum industry occur as a result of combustion processes. These combustion processes deliver the energy for three main production steps (Entec, 2006):

- Drying the raw gypsum feed (natural or synthetic) to achieve ~0.5 % moisture content
- Calcining the gypsum, and
- Drying of the final plasterboard product.

The majority of gypsum plants use direct combustion to deliver the heat for calcining and drying. As a consequence the associated CO₂ emissions are attributed to the respective gypsum installation.

With reference to 'The perfect loop, the path to a circular economy: a European collaborative project between the recycling industry, the demolition sector and the gypsum industry' (Gypsum to Gypsum 2015), GtoG, the life cycle of gypsum plasterboard begins with the extraction and processing of raw materials, continues with the production and use of plasterboard, until it reaches the End of Life, which involves landfilling, recycling or other forms of recovery (as shown on Figure 10-1).



Figure 10-1 Life Cycle Stages.

Figure 10-2 shows the representative stages of gypsum plasterboard life cycle and their relation to EN 15804:2012, which specifies the life cycle stages.

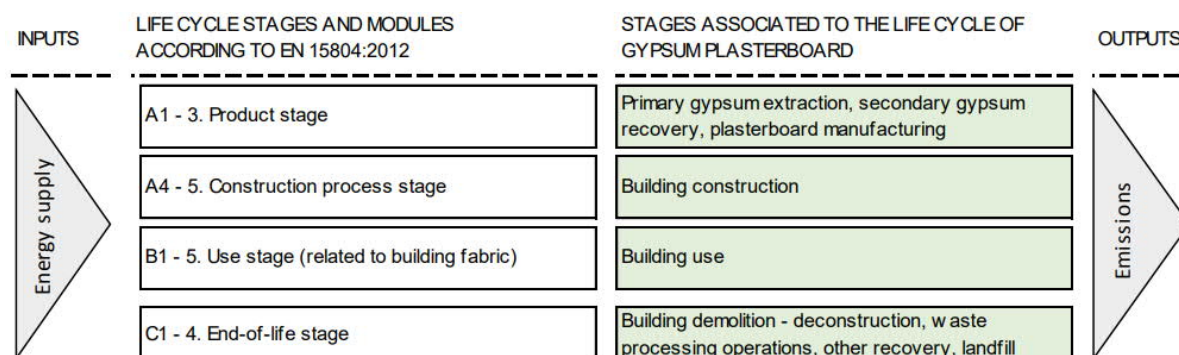


Figure 10-2 Representative Stages of Gypsum Plasterboard Life Cycle and their Relation to EN15804:2012

The Applicant continually monitors the environmental impact of their products from raw material extraction through to the end of their life at demolition and recycling via industry recognised and independently verified Life Cycle Assessment (LCA) methods. The Applicant also ensures that materials are close to customers and are transported in the most environmentally, efficient and safest method possible. They are consistently setting resource efficiency targets to reduce energy and water consumption, as well as aiming to eliminate all non-recyclable waste going to landfill from operations (as described further below).

The results of the LCA for the Kingscourt Works are checked and verified by an independent third party (called an Environmental Product Declaration or EPD), it is said to be 'verified'. In terms of the LCA, this chapter only focuses on the product stage, of which the associated greenhouse gas emissions are detailed further below. Within the product stage, are two key steps which relate to the Proposed Licence Amendment:

- Raw materials – gypsum as a sustainably extracted resources, and
- Manufacturing - a process with low emissions and measured water consumption.

Natural gypsum is extracted at the mine site north of Kingscourt. Extracting natural gypsum does not require much energy. Raw materials are the ingredients and materials that are used directly in product realisation. These include chemicals additives, stucco, paper, glue, etc. In this case, raw materials also refer to other materials that allow for delivery of product to customers – pallets, strapping, bags for plaster, tubes for adhesives etc.

The mine site comprises an open pit gypsum mine, underground gypsum mine, settlement lagoons, processing plant, non-extraction areas, administration buildings and a car park (KD Environmental 2019). Activities at the mine site include crushing plant, lorry loading facilities, a workshop, storage silos, office buildings and a water lagoon system. The produce from the site supplies a plasterboard factory owned and operated by Saint-Gobain referred to in this document as the factory site

It is practice at the Kingscourt Works that only commonly available, abundant materials are used in production of finished product. Key performance indicators track the quantity and volumes of renewable, recycled and recyclable materials used by the Applicant's production of plasterboard and plaster products.

Condition 7.4 of the IED (Industrial Emissions Directive) licence issued by the EPA requires that the Applicant perform and document an assessment of efficiency of raw materials use and where improvements have been identified these improvements should be included in the environmental targets and objectives programme for the Applicant's operations. These assessments are continual, and the implementation of recommendations result in ongoing increased raw materials efficiency.

The Applicant operates a plasterboard recycling system whereby via a permitted waste contractor off cuts of plasterboard and old plasterboard is collected on customers sites and transported back to the Kingscourt works. Collected waste plasterboard is recycled on site through the manufacturing process.

In 2019, 991 Tonnes of waste plasterboard was collected from customers and recycled at the Kingscourt site. Waste plaster and plasterboard produced on site is recycled through the provision of 'Agrigyp' to the mushroom industry.

10.4.1.2.1 Energy Efficiency

Energy Efficiency is a measure of how much energy is used for every tonne of plaster product and plasterboard. In 2019, all electricity used on the Kingscourt Works Site was generated from renewable sources. Overall Energy Use in 2019 was 259,034 MWHrs (including mining operations).

In 2019, the Applicant identified key areas for improved energy efficiency energy and completed a number of energy saving projects. The Applicant continues to set stringent targets for energy use and strive for improvement in energy efficiency for 2020 and beyond.

In terms of energy efficiency, the Applicant's operations are compliant with Greenhouse Gas Emissions Permit IE-GHG002-10335-4 (as described further below). To meet the requirements of this permit, the Applicant actively and continually reviews and assesses energy use focusing on past and present energy use and significant energy users.

The Applicant operates an energy management system that is ISO 50001 accredited. External and internal audits are routinely performed to ensure compliance.

KPIs are set for energy efficiency and reviewed on a continual basis with a documented energy plan and a dedicated energy engineer on site.

10.4.1.2.2 Greenhouse Gas Emissions

The Applicant is required on an annual basis to:

- Quantify its 'Direct' Greenhouse Gas Emissions in order to participate in greenhouse gas emission allowance trading within the community. These requirements are complied with through the details outlined in it's the Greenhouse Gas permit as issued by the EPA. The Applicant complies with this requirement through the production of its Annual Emission Report, and
- The Applicant also reports to its stakeholders on the 'indirect' Greenhouse Gas emissions and removals of greenhouse gases according to BES 6001 standard (and the principles of ISO 14064-1).

10.4.1.2.2.1 Direct Greenhouse Gas Emissions

The operations associated with the mining and factory site at the Kingscourt Works are authorised under a Greenhouse Gas Emissions Permit (IE-GHG002-10335-4), which allows the Applicant to undertake named activities resulting in emissions of carbon dioxide from listed emission sources. It also contains requirements that must be met in respect of such emissions, including monitoring and reporting requirements. This Greenhouse Gas Emissions Permit places an obligation on the Applicant to surrender allowances to the EPA equal to the annual reportable emissions of carbon dioxide equivalent from the installation in each calendar year, no later than four months after the end of each such year.

The current permit was issued on 03rd February 2016, replacing the previous permit issued on 29th April 2013. Key changes between permits included:

- Change of operator name from Gypsum Industries Limited to Saint-Gobain Construction Products (Ireland) Limited
- Removal of S26 & S36 and inclusion of (S40, S41 & S42) all minor emission sources. These are emission references which relate to specific sources associated with the site
- Minor update to emission points (Canteen removed, BE17 & BE18 added)
- Update of capacities for S29, S30, S35, & S37 following audit reviews. The total capacity is now 60.35 MW, and
- Update to management procedures and references following internal audit.

The issuing of the permit is done under the regulatory authority of the EPA, who is satisfied, on the basis of the information available, that subject to compliance with the conditions of the permit, the Operator is capable of monitoring and reporting emissions in accordance with the requirements of the Regulations in relation to the following activity:

- Drying or calcination of gypsum or production of plaster boards and other gypsum products, where combustion units with a total rated thermal input exceeding 20 MW are operated.

As set out in the permit, carbon dioxide from Schedule 1 activities shall be emitted to atmosphere only from the emission sources as listed in Table 2 of the permit. The activity shall be controlled, operated and maintained so

that emissions of carbon dioxide shall take place only as set out in the GHG Emissions Permit. The permit does not control emissions of gases other than carbon dioxide. All agreed plans, programmes and methodologies required to be carried out under the terms of the permit, become part of the permit.

The Kingscourt works operates a standalone manufacturing site (the factory site) producing plaster-based products. The installation has two main process steps:

- The production of plasters, and
- The conversion of plasters into plasterboard.

Details of the estimated annual emission of CO₂ equivalent are provided in the permit. This information enables categorisation of the installation in accordance with Article 19 of the MRR and is based on the average verified annual emissions of the previous trading period data or if this data is not available or is inappropriate a conservative estimate of annual average emissions including transferred CO₂ (excluding CO₂ from biomass).

In 2019, the total CO₂ emissions for the gypsum mine and processing facilities combined was 50,466 tonnes CO₂(e) per annum. This represented a 17% increase over 2018 emissions versus a 22% increase in production. Whilst showing an increase in emissions on those reported in 2018 due to increased production, the positive effect of Identified Energy projects and Energy savings achieved during 2019 were evident in certain areas.

These savings are still being offset by Process changes / improvements that were required to maintain consistent supply of quality product to customers. Additional Energy Saving projects assigned for 2020 are anticipated to achieve improved performance in 2020 and beyond.

Section 6 of the permit sets out the emissions details for the Kingscourt Works, including the emissions sources and emission points. It also includes source streams (fuels and/or materials) and associated activities, which, in the main is associated with the drying or calcination of gypsum or production of plaster boards and other gypsum products, where combustion units with a total rated thermal input exceeding 20 MW are operated.

There are also certain activities that result in greenhouse gas emissions which may be excluded under the EU ETS Directive (i.e. mobile sources such as vehicle emissions), however none have been identified in the monitoring plan.

Emissions at the Kingscourt site are determined using a calculation-based methodology ("calculation") to determine annual CO₂ emissions:

Natural gas is used extensively throughout the site and accounts for 99.5% of the combustion activities at the site. Records of monthly gas invoices are used to quantify overall gas usage in the site. Gas invoices are calculated using the Gas Networks Ireland flow meter situated in the above ground installation (AGI) at Ballynaclose. The energy consumption at the site is calculated by multiplying the volume of gas used by its calorific value. The calorific value is calculated by a chromatograph located at Brownsbarn, 30 km from the Ballynaclose AGI. An average daily calorific value is used in the calculation of consumption. The KWH and gas volume are recorded in a spreadsheet on a monthly basis. These figures are used to quantify the tonnes of CO₂ produced.

Gas oil is used in the office heating oil tank on site. Emissions related to gas oil are determined by means of routine examination of the invoices from the supplying company and reference to the national standards published for NCV (Net Calorific Value) and EF (Emission Factors). Records of monthly gas oil invoices for the office tank are used to quantify overall gas oil usage, taking into account the closing stock oil 'remaining' in the office heating tank at year end. A stock level measurement 'dip' shall be recorded at current year end to provide a final 'closing stock' measure, this will be used to record an 'opening stock' measure on the Excel spreadsheet maintained on Environmental 'V' drive for the incoming year.

Propane gas is used in the Lab on site. Propane usage on site is calculated by reference to invoiced quantities. As consumption is very low a "note here" approach has been adopted. This assumes that any propane purchased during the year is combusted. Data for NCV and EF are taken from the latest national inventory data as submitted to the UNFCCC.

Records of acetylene usage are measured on an annual basis by recording the opening stocks, closing stocks and purchases during the reporting period. As consumption is very low a "note here" approach has been adopted. This CO₂ emission will be monitored by reference to supplier's invoices and the nationally published calculation factors for NCV and EF.

10.4.1.2.3 Notification of Change

The permit also sets out a number of conditions, including Condition 2 which states that no alteration to, or reconstruction in respect of, the activity or any part thereof which would, or is likely to, result in a change in:

- The nature or functioning of the installation
- The capacity of the installation as detailed in the permit
- The fuels used at the installation, and/or
- The range of activities to be carried out at the installation.

that may require updating of the GHG permit shall be carried out or commenced without prior notice to and without the prior written agreement of the EPA.

10.4.1.2.4 Monitoring and Reporting

In accordance with the requirements of Condition 3 as set out within the permit, the Applicant is required to monitor and record greenhouse gas emissions on site in accordance with the M&R Regulation (Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and any amendments or revisions thereto) and the approved Monitoring Plan attached at Appendix 1 of the permit and in compliance with any other guidance approved by the EPA for the purposes of implementing the Directive and / or the Regulations.

The Applicant is also required to modify the monitoring plan in any of the following situations:

- New emissions occur due to new activities carried out or due to the use of new fuels or materials not yet contained in the monitoring plan
- The change of availability of data, due to the use of new measurement instrument types, sampling methods or analysis methods, or for other reasons, leads to higher accuracy in the determination of emissions
- Data resulting from the previously applied monitoring methodology has been found incorrect
- Changing the monitoring plan improves the accuracy of the reported data, unless this is technically not feasible or incurs unreasonable costs
- The monitoring plan is not in conformity with the requirements of the M&R Regulation and the Agency requests a change, and
- It is necessary to respond to the suggestions for improvement of the monitoring plan contained in the verification report.

10.4.1.2.5 Allowances

In accordance with the requirements of Condition 4 as set out within the permit, the Applicant is required by 30 April in each year, surrender to the EPA, or other appropriate body specified by the EPA, allowances equal to the annual reportable emissions in the preceding calendar year.

The number of allowances to be surrendered shall be the annual reportable emissions for the preceding calendar year plus such allowances as may be necessary to cover any earlier calendar year in respect of which allowances remain outstanding and due. This includes allowances to cover the amount of any annual reportable emissions in respect of which allowances were not surrendered in accordance with that stated above in the previous year, and the amount of any reportable emissions which were discovered during the previous year to have been unreported in reports submitted under Condition 3 in that or in earlier years.

In relation to activities or parts of activities which have ceased to take place and have been notified to the EPA in accordance with Condition 2 above, the Operator shall surrender to the EPA allowances equal to the annual reportable emissions from such activities in the preceding calendar year or part thereof, together with such allowances as may be necessary to cover any earlier calendar year in respect of which allowances remain outstanding and due as described in Condition 4.1.2 above

10.5 Assessment of Potential Impacts

Following a recent alteration in the existing water management procedure at the Drummond mine site the Applicant are applying for a review of their existing IEL No. P0519-03. This IEL review applies to the mine site operations only and will seek to increase the current compliance limit value for sulphate from the current level of 200 mg/L to 1,250 mg/L and for electrical conductivity 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 (in the River Bursk). Further details the characteristics of the Proposed Licence Amendments is available in Chapter 1 Introduction, Section 1.2 and Chapter 3 Project Description, Section 3.4.

As set out previously, the EIA Directive requires the assessment of impact upon climate (e.g. greenhouse emissions) and vulnerability of the project to climate change. In respect of the Proposed Licence Amendment, there are generally two key aspects considered within this chapter in terms of potential impacts:

- Climate change mitigation – impact of the operations of the mine and factory site as a consequence of the Proposed Licence Amendment upon climate change, primarily through greenhouse gas emissions (direct and indirect), and
- Climate change adaptation – vulnerability of operations of the mine and factory site as a consequence of the Proposed Licence Amendment to future changes in climate and its capacity to adapt to the impacts of climate change.

10.5.1 The Mine Site

10.5.1.1 Life Cycle Assessment

As detailed within Section 10.4.1.2, the mine site is responsible for the raw material extraction element of the life cycle staged process, in which it is recognised that the extraction of natural gypsum does not require much energy. As this proposal simply relates to a change in the water management procedure at the mine site and seeks to obtain an increased ELV for sulphate and electrical conductivity, there is no predicted impact upon current operations (as described previously). It is envisaged that there would be no perceptible change to plant, machine and vehicle usage, and thus no deleterious impact upon associated emissions (i.e. as a result of increased fuel consumption).

As noted previously, the Applicant continually monitors the environmental impact of their products from raw material extraction through to the end of their life at demolition and recycling via industry recognised and independently verified LCA methods. It is not envisaged that any review or change to this process will be necessary as a result of the Proposed Licence Amendment.

The Proposed Licence Amendment would also have no additional land requirements that could result in the loss of carbon sinks, such as forests, woodland and vegetation as the operational area is currently functioning as an active mine and no changes are proposed to accommodate the change.

10.5.1.2 Climate Change Resilience

The key aspect of the climate change resilience review is building climate resilience into the design of the project at an early stage. This aspect is to an extent relevant to the Proposed Licence Amendment as it relates to water management procedures as a consequence of significant and unexpected ingress to the site. This aspect has been considered more appropriately within Chapter 8: Water (Hydrology and Hydrogeology) in terms of existing constraints and the methods deemed necessary to manage the issue appropriately and sustainably.

There are no other aspects to be considered from a climate change resilience perspective due to the fact that the site is currently operational. For example, the impact of weather on both normal operations and extreme weather-related disaster scenarios are already managed by the mine's current operational procedures. As noted previously, there is a reliance on utility and transport networks within and between sites, however these again are fully managed through the sites standard operating procedures.

10.5.2 The Factory Site

10.5.2.1 Life Cycle Assessment

The Proposed Licence Amendment relates solely to discharges from the mine site. It would have no bearing on the manufacturing (product) stage of the life cycle process and associated greenhouse gas emissions, which although has seen an increase in emissions in recent years, is generally deemed a manufacturing process with low emissions and measured water consumption. Consequently, in consideration of the Proposed Licence Amendment in isolation, there would be no impact upon direct or indirect greenhouse gas emissions from the factory site.

Furthermore, it is not envisaged that the Proposed Licence Amendment would have any direct bearing on the ability of the Applicant to meet the conditions or requirements as set out in Greenhouse Gas Emissions Permit (IE-GHG002-10335-4), including monitoring and reporting requirements. The Proposed Licence Amendment would not constitute a Schedule 1 activity as an identifiable emission source requiring regulation or requiring any change to those already identified within Table 2 of the permit. The Proposed Licence Amendment is also unlikely to constitute a notifiable change in conditions, as set out in Condition 2 of the permit or require additional monitoring and reporting, as required by Condition 3 of the permit.

10.5.2.2 Climate Change Resilience

As there are no proposals to change or alter operations at the factory site, there is no requirement to consider climate change resilience within the assessment.

10.6 Mitigation Measures

None proposed.

10.7 Cumulative Impacts

None predicted.

10.8 Residual Impacts

Residual impacts are defined as those impacts that remain following the implementation of the mitigation measures proposed. As no such measures are proposed, the residual climate impacts are the same as those described above.

10.9 Summary

The impact of the operations of the mine and factory site as a consequence of the Proposed Licence Amendment upon climate change, primarily through greenhouse gas emissions (direct and indirect) as well as the vulnerability to future changes in climate and its capacity to adapt to the impacts of climate change has been considered in the assessment.

As the Proposed Licence Amendment simply relates to a change in the water management procedure at the mine site and seeks to obtain an increased ELV for sulphate and electrical conductivity, there is no predicted impact upon current operations at the mine site. Consequently it is envisaged that there would be no perceptible change to plant, machine and vehicle usage, and thus no deleterious impact upon associated emissions is expected. There would be no associated change to the life cycle process of the mine site, nor would additional land be required that could result in the loss of carbon sinks, such as forests, woodland and vegetation.

As the Proposed Licence Amendment relates solely to discharges from the mine site, it would have no bearing on the manufacturing (product) stage of the life cycle process and associated greenhouse gas emissions, which although has seen an increase in emissions in recent years, is generally deemed a manufacturing process with low emissions and measured water consumption. Consequently, in consideration of the Proposed Licence Amendment in isolation, there would be no impact upon direct or indirect greenhouse gas emissions from the factory site. Furthermore, it is not envisaged that the Proposed Licence Amendment would have any direct bearing on the ability of the Applicant to meet the conditions or requirements as set out in Greenhouse Gas Emissions Permit (IE-GHG002-10335-4), including monitoring and reporting requirements.

There are no concerns from a climate resilience perspective in both the mine and factory sites.

11 Noise and Vibration

11.1 Introduction

This chapter considers the noise and vibration related impacts associated with the Proposed Licence Amendment to increase the ELV for sulphate and electrical conductivity at Compliance Point CP-1 at the mine site. The Applicants existing operations are covered by IEL P0519-03 which is issued by the EPA. The emissions limits for noise and vibration at both the mine and factory sites are determined by and detailed within IEL P0519-03. The noise and vibration limits as set out within IEL P0519-03 was considered within this chapter.

The Proposed Licence Amendment does not seek to increase noise and vibration limits as pertained to the existing IEL P0519-03. The activities relating to the Proposed Licence Amendment will not lead to an increase in noise and vibration within the existing environment and as such it was determined noise monitoring was not required and a detailed environmental assessment is not required as part of this EIAR.

11.2 Methodology

Existing noise monitoring information relating to annual noise monitoring carried out in 2018 and 2019 in line with the requirements as set out within IEL P0519-03 have been considered within this chapter. An environmental baseline was established using information available online such as the Nam Acoustics Noise Survey Compliance Report 2018, information contained within the Annual Environmental Report (AER) and information provided by the Applicant (Nam Acoustics Noise Survey Compliance Report 2019).

Nam Acoustics carried out a noise survey in June, July and November 2018 at the Saint Gobain mine and processing sites. Daytime measurements were carried out between 09:00 and 17:00, evening measurements were carried out between 19:00 and 23:00 and night-time measurements were carried out between 23:00 and 02:00. While in 2019 noise monitoring was carried out in July and September 2019. Daytime measurements were carried out between 09:00 and 18:45. Evening measurements were carried out between 21:00 and 23:00, and night-time measurements were carried out between 23:00 and 02:30. Both the 2018 and 2019 surveys were carried out as part of the annual compliance report for the IPPC License No. P0519-03.

11.2.1 Sources of Information

In preparing this report reference has been made to the following documents:

- EPA, IEL P0519-03 (EPA 2015)
- Noise Survey Compliance Report 2018 for Saint-Gobain Construction Products (Ireland) Limited IPPC Licence No. P0519-03 (Nam Acoustics November 2018)
- Noise Survey Compliance Report 2019 for Saint-Gobain Construction Products (Ireland) Limited IPPC Licence No. P0519-03 (Nam Acoustics November 2019)
- Knocknacran Open-pit Mine, Environmental Impact Assessment. Report Number 1668466.R01.EIS.A0 submitted to Monaghan County Council. (Golder Associates 2017), and
- Annual Environmental Report 2019 (SGCPI, 2019).

11.2.2 Legislation and Guidance

The following policy and legislation has been considered when producing the baseline information:

Table 11-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed in an EIAR, this includes noise and vibration
S.I. No. 296 of 2018, European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	Directive 2014/52/EU is transposed into Irish Law under S.I. No 296. The Regulations describes the EIA process and lists noise and vibration as a factor to be contained in an EIAR.
Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017)	The Draft Guidance outlines environmental factors to be included in an EIAR which includes noise and vibration. The guidance also outlines the process to follow when carrying out an impact assessment as part of an EIAR.
Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA 2016)	This document assists licensed sites with the assessment of their potential and actual noise impact on the local environment. It provides the relevant knowledge and guidance to licensees together with their consultants, regulators and interested third parties.

11.2.3 Study Area

Annual noise monitoring by Nam Acoustics occurred at the noise monitoring locations of relevance to the existing IEL P0519-03. Further information on these noise monitoring locations are detailed below. The noise monitoring locations take into consideration the closest sensitive receptors to both the mine and factory site. There mine site noise monitoring locations are MS1 to MS3 (see Volume 3, Appendix A.11.1, Figure A11-1) and the factory site noise monitoring locations are N1 to N5 (see Volume 3, Appendix A.11.1, Figure A11-2).

11.2.4 Significance / Evaluation Criteria

The Proposed License Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 at the mine site only and will not require any additional infrastructure to be built or any existing infrastructure to be updated. As the Proposed License Amendment does not look to alter any noise related limits or monitoring requirements as outlined within IEL P0519-03 and will not introduce any additional noise sources to the factory or mine site, it has been determined a detailed environmental assessment was not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

11.2.5 Limitations in the Methodology and Gaps in Information

The information contained within this chapter is based upon information produced by others and available on the EPA licensing web portal. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the noise and vibration conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM

11.3 Description of the Existing Environment & Baseline Information

11.3.1 Noise and Vibration Aspects of IEL P0519-03

The noise and vibration emissions limit values and control and monitoring conditions set out within IEL P0519-03. Noise limits as set out within Schedule B of IEL P0519-03 are listed in Table 11-2.

Some of the conditions set out within IEL P0519-03 relating to noise and vibration are listed below:

- No blast or combination of simultaneous blasts shall give rise to a vibration level at any noise sensitive location which exceeds a peak particle velocity of 7.5 mm / second, as measured in three mutually orthogonal directions about a fixed point*
- No blast or combination of simultaneous blasts shall give rise to an air-overpressure level at any noise sensitive location which exceeds 125 dB (lin) max peak*

- *There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location other than when blasting occurs or when a siren is used to give blast warnings*
- *The licensee shall carry out a noise survey of the installation operations annually. The survey programme shall be undertaken in accordance with the methodology specified in the 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)' as published by the Agency. The licensee shall consult with the Agency on the timing of the survey. A record of the survey results shall be available for inspection by any authorised persons of the Agency at all reasonable times and a summary report of this record shall be included as part of the AER, and*
- *Off-site noise, vibration & air overpressure*
 - *(Noise from the installation shall not give rise to sound pressure levels (Leq, T) measured at noise sensitive locations of the installation which exceed the limit value(s).*
 - *Vibration levels measured at noise sensitive locations shall not exceed the specified limit values*
 - *Air overpressure levels measured at noise sensitive locations shall not exceed the specified limit values.*

Table 11-2 Noise Limits as Identified in IEL P0519-03

Daytime dB Lar, T (15 minutes)	Evening dB Lar, T (15 minutes)	Night-time dB LAeq, T (15 minutes)
55	50	45

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

Source: <IEL P0519-03, Section B.4, page 36>

11.3.2 The Surrounding Environment

11.3.2.1 The Mine Site

The surrounding environment is predominately agricultural with single-house residential dwellings, and small businesses such as petrol stations. Residential dwellings generally occur along local roads adjacent of the mine site with a small residential housing area located in Clonscady to the north of the mine site. The mine site operates in line with the noise limits outlined within IEL P0519-03 (see Table 11-2).

The predominant noise sources are heavy plant and machinery loading and unloading gypsum product from the mine (Nam Acoustics 2018 & 2019). At the mine site Nam Acoustics (2018 & 2019) noted daytime noise levels were dominated by extraneous noise sources such as activity at a petrol station (noise monitoring location MS2) while daytime and night-time noise levels were affected by a busy roadway the R179 (noise monitoring location MS1 and MS2).

11.3.2.2 The Factory Site

The surrounding environment is predominately agricultural with single-house residential dwellings. Residential dwellings generally occur along local roads adjacent of the factory site with a small residential housing area located at Ballinaclose to the south of the factory site. Industrial sheds are located to the east of the factory site. The factory site operates in line with the noise limits outlined within IEL P0519-03 (see Table 11-2).

Noise sources at the factory site are described as continuous and broadband in nature (Nam Acoustics 2018). The factory site is serviced by haulage trucks and other traffic. The factory site is located adjacent to the R162, a busy road which is noted by Nam Acoustics (2018 & 2019) as a busy passageway which affects the measured daytime and evening time noise levels at 3 noise monitoring points (N1, N2 and N5). Other noise sources at noise monitoring locations included bird activity, agriculture related noise sources, animals in nearby fields, residential activity and dogs barking (noted by Nam Acoustics 2018 & 2019 at noise monitoring locations N3 and N4).

11.3.3 Noise Monitoring Locations & Sensitive Receptors

11.3.3.1 Mine site

There are three monitoring locations located at the mine site MS1, MS2 and MS3 (Volume 3, Appendix A.11.1, Figure A11-1).

- MS1 is located to the north of the mine site. The nearest residence to MS1 is circa 100 m north of this noise monitoring location (Nam Acoustics 2018 & 2019; Golder Associates 2017)
- MS2 is located to the west of the mine site. The nearest residence is circa 20 m west of this noise monitoring location (Nam Acoustics 2018 & 2019; Golder Associates 2017), and
- MS3 is located to the south east of the mine site. The nearest residence is circa 300 to 400 m to the north east of the monitoring location (Nam Acoustics 2018 & 2019; Golder Associates 2017).

11.3.3.2 Factory Site

There are 5 noise monitoring locations at the factory site, N1, N2, N3, N4, N5 (Volume 3, Appendix A.11.1, Figure A11-2).

- N1 is located to the south east of the factory site and is adjacent to the R162. The nearest noise sensitive location is said to be sited circa 60 m from the N1 noise monitoring location (Nam Acoustics 2018 & 2019). N2 is situated to the north west of the factory site, adjacent to the truck entrance to the factory site
- N2 is adjacent to two residential dwellings and the R162 roadway. The R162, a treeline, and shrubbery occur between the residential dwellings and the factory site. Occasional truck traffic enters and leaves the factory site
- N3 is located to the south west of the factory site. The nearest noise sensitive location is documented by Nam Acoustics (2018 & 2019) is sited circa 40 m from the N3 noise monitoring location
- N4 is located to the north east of the factory site. The nearest noise sensitive location is documented by Nam Acoustics (2018 & 2019) is sited circa 40 m from the noise monitoring location, and
- N5 is located to the west of the factory site. The nearest noise sensitive location is documented by Nam Acoustics (2018 & 2019) is sited circa 15 m from the noise monitoring location. The property is also adjacent to the R162 roadway.

11.3.4 Noise Monitoring Results

11.3.4.1 Mine site Annual Monitoring Results 2018 & 2019

MS1

In 2018 Nam Acoustics (2018) noted a steady stream of traffic adjacent to this noise monitoring location during their night-time measurements. Other noise sources identified at this location include mine heavy plant traffic, loading and unloading. L_{AF90} noise levels measured 34 dB during evening time noise measurement period. Daytime, evening time and night-time noise levels were identified by Nam Acoustics (2018) as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

The 2019 AER identified noise sources similar to those identified in 2018 by Nam Acoustics such as heavy plant traffic, loading and unloading several hundred metres from this monitoring point, and a distant almost continuous, stream of passing road traffic. Similar to 2018, Nam Acoustics (2019) measured L_{AF90} noise levels of 34 dB during the evening time noise measurement period. The 2019 AER and Nam Acoustics (2019) identified noise levels as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

MS2

In 2018 Nam Acoustics (2018) identified that day time noise levels are dominated by activities relating to a shop and filling station located adjacent to the noise monitoring location. The passing traffic on the R179 was also found to influence noise readings at the noise monitoring location. Evening time measurements were also influenced by passing traffic. Daytime, evening time and night-time noise levels were identified by Nam Acoustics (2018) as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

The 2019 AER identified noise sources similar to those identified in 2018 by Nam Acoustics such as passing road traffic noise and activity emanating from a nearby shop and filling station, and faintly noticeable operations at the mine. In 2019 Nam Acoustics measured L_{AF90} noise levels of 37 dB during evening time noise measurement period

at this monitoring location. The 2019 AER and Nam Acoustics (2019) identified noise levels as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

MS3

In 2018 Noise sources noted by Nam Acoustics (2018) at this monitoring location was a discharge pump filling water to a holding tank. Daytime, evening time and night-time noise levels were identified by Nam Acoustics (2018) as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

The 2019 AER and Nam Acoustics (2019) identified noise sources the same as that identified by Nam Acoustics in 2018. The 2019 AER and Nam Acoustics (2019) identified noise levels as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

11.3.4.2 Factory Site Annual Monitoring Results 2018 & 2019

N1, N2 and N5

Daytime and evening time noise levels at noise monitoring location N1, N2 and N5 are noted by Nam Acoustics (2018 & 2019) as being heavily influenced by passing traffic with a continuous stream of road traffic occurring adjacent to the monitoring location. Other noise sources identified in 2018 and 2019 (as identified by Nam Acoustics 2018 and the 2019 AER) at these locations include Mill Plant running, Board Plant running, site traffic and loading by forklift trucks.

In 2018 the average L_{AF90} noise levels recorded by (Nam Acoustics 2018) at N1 measured 53 dB during daytime and 46 dB during evening time noise measurement periods. At N2 the average L_{AF90} noise levels measured 49 dB during daytime and 45 dB during evening time noise measurement periods. At N1, N2 and N3 night-time noise measurements were not found to be influenced by road traffic. At N5 average L_{AF90} noise levels measured 49 dB during daytime and 47 dB during evening time noise measurement periods. Daytime, evening time and night-time noise levels were identified by Nam Acoustics (2018) as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

In 2019 the average L_{AF90} noise levels recorded by (Nam Acoustics 2019) at N1 was 51 dB during daytime and 45 dB during evening time noise measurement periods. At N2 the Average L_{AF90} noise levels measured 45 dB during daytime and 46dB during evening time noise measurement periods. At N5 the average L_{AF90} noise levels measured 49 dB during daytime and 46 dB during evening time noise measurement periods. At N1, N2 and N3 night-time noise measurements were not found to be unduly influenced by extraneous noise sources as road traffic had abated at the time of the measurement period (Nam Acoustics 2019). The 2019 AER and Nam Acoustics (2019) identified noise levels at N1, N2 and N5 as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

N3

In 2018 noise sources identified by Nam Acoustics (2018) at this location include Mill Plant running, Board Plant running, site traffic and loading by forklift trucks. In 2018 Nam Acoustics identified an evident 25Hz tone during daytime, evening time and night-time noise measurement periods and the tone was said to be under investigation. A 5-dB penalty was applied to the daytime, evening time and night-time noise levels. With the penalty applied noise levels were documented by Nam Acoustics (2018) as on or below the licence limits at 55 dB at daytime, 50 dB at evening time and 45 dB at night-time and considered to be within the licence criteria at the nearest sensitive location to this monitoring point.

The Nam Acoustics (2019) (and the 2019 AER) identified noise sources, similar to that identified by Nam Acoustics in 2018, mill plant running, and board plant running. As in 2018 a tonal or impulse noise was also identified during day and evening time periods and a 5 dB penalty was applied at this location. Nam Acoustics (2019) identified noise levels at this location as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

N4

In 2018 and 2019 Nam Acoustics note this site is circa 750 m from the processing site and very low noise level occur at this location.

A tonal component in the 500Hz one third octave band was identified by Nam Acoustics (2018) during one of their night-time measurements however it was not evident in a subsequent measurement and is not suspected to have emanated from the processing site. Other noise sources identified at this location include mill plant running, board

plant running, site traffic and loading by forklift trucks. Daytime, evening time and night-time noise levels were identified by Nam Acoustics (2018) as being compliant with licence criteria at the nearest sensitive location to this monitoring location.

The 2019 AER identified noise sources at this site to be mill plant running, and plasterboard plant running, a tonal noise was also detected and was reported to be due to birdsong. In 2019 Nam Acoustics identified a tonal component in the 8 kHz one third octave band in one of the day-time measurements, this was not evident in a subsequent measurement and was not suspected to have emanated from the factory site. Nam Acoustics (2019) attributed it to from birdsong close by due to the frequency band associated with the noise source. The 2019 AER noted a tonal or impulse noise identified during the night-time time period, but no dB penalty was applied. The 2019 Nam Acoustics (2019) identified noise levels at this location as being compliant with licence criteria at the nearest sensitive location to this monitoring point.

11.3.5 Quarterly Blast and Vibration Monitoring Results

Quarterly Blast and Vibration Monitoring Results for 2019 submitted by the Applicant to the EPA show that vibration results were in compliance with the limits set out within IEL P0519-03.

Table 11-3 Quarterly Blast and Vibration Monitoring Results for 2019 for the Mine Site, Latest Data as Submitted to the EPA

Date 2019	Limits				MS1				MS2				MS3			
	L mm/s	T mm/s	V mm/s	AOP dB	L mm/s	T mm/s	V mm/s	AOP dB	L mm/s	T mm/s	V mm/s	AOP dB	L mm/s	T mm/s	V mm/s	AOP dB
24/01	7.5	7.5	7.5	125 dB	Failed to Trigger				0.6	0.8	0.3	1120	0.8	0.8	0.6	115.0
14/02	7.5	7.5	7.5	125 dB	Failed to Trigger				Failed to Trigger				1.0	0.8	0.3	110.0
28/02	7.5	7.5	7.5	125 dB	Failed to Trigger				Failed to Trigger				0.8	0.6	0.5	110.0
14/03	7.5	7.5	7.5	125 dB	Failed to Trigger				1.3	1.5	0.8	110.0	2.0	1.1	1.0	14.0
04/04	7.5	7.5	7.5	125 dB	Failed to Trigger				1.1	1.3	0.8	109.9	1.4	1.0	1.1	112.0
19/05	7.5	7.5	7.5	125 dB	Failed to Trigger				0.8	0.5	0.5	114	0.6	0.4	0.3	106
06/06	7.5	7.5	7.5	125 dB	0.4	0.5	0.3	116.0	0.8	0.8	0.5	117.0	1.5	2.2	1.5	107.5
27/06	7.5	7.5	7.5	125 dB	Failed to Trigger				1.0	1.0	0.8	116	0.8	0.6	0.4	110
11/07	7.5	7.5	7.5	125 dB	Failed to Trigger				0.8	0.8	0.5	114	1.3	0.8	0.9	106
25/07	7.5	7.5	7.5	125 dB	Failed to Trigger				0.6	0.5	0.3	110	Failed to Trigger			
01/08	7.5	7.5	7.5	125 dB	Failed to Trigger				0.7	0.6	0.4	107	Failed to Trigger			
15/08	7.5	7.5	7.5	125 dB	Failed to Trigger				1.1	0.8	0.7	111.8	Failed to Trigger			
22/08	7.5	7.5	7.5	125 dB	Failed to Trigger				1.0	0.6	1.1	106	0.6	0.6	0.4	108.0
05/09	7.5	7.5	7.5	125 dB	Failed to Trigger				0.7	0.7	0.6	98	0.6	0.6	0.4	114.4
12/09	7.5	7.5	7.5	125 dB	Failed to Trigger				1.1	1.0	0.7	100	0.8	0.8	0.2	116.4
19/09	7.5	7.5	7.5	125 dB	Failed to Trigger				0.8	1.0	1.5	110	0.6	0.6	0.3	104.2

Date	Limits				MS1	MS2				MS3			
2019													
26/09	7.5	7.5	7.5	125 dB	Instrument Malfunction	1.2	0.6	1.2	110	Failed to Trigger			
03/10	7.5	7.5	7.5	125 dB	0.6 0.5 0.7 113	Failed to Trigger				0.6 0.5 0.4	100		
10/10	7.5	7.5	7.5	125 dB	Failed to Trigger	0.6 1.1 0.6	110	0.5 0.4 0.3	116.3				
17/10	7.5	7.5	7.5	125 dB	Failed to Trigger	1.1 1.1 2.1	108	Failed to Trigger					

Source: <Quarterly Blast and Vibration Monitoring Results submitted by the Applicant to the EPA under IEL P0519-03>

11.4 Assessment of Potential Impacts / Comments on Monitoring Results

The annual noise monitoring of the mine site in 2018 and 2019 by Nam Acoustics (and the 2019 AER) concluded noise levels were compliant with licence criteria at the nearest sensitive locations to noise monitoring locations at the mine and factory sites. In addition, as previously mentioned the Proposed Licence Amendment is related to a request to increase the ELV for sulphate at from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 and will not affect the surrounding noise environment. The Proposed Licence Amendment does not look to alter any noise related limits or monitoring requirements as set out within the existing IEL P0519-03. In light of this a detailed assessment of noise and vibration has not been carried out.

11.4.1 The Mine Site and The Factory Site

The annual noise monitoring of the mine site in 2018 and 2019 by Nam Acoustics conclude the noise levels were compliant with licence criteria at the nearest sensitive locations to the noise monitoring locations at the mine and factory sites.

11.5 Mitigation Measures

Mitigation measure currently employed on site are those set out within IEL P0519-03. A number of additional mitigation measure have also been outlined in previous EIAR for the mine such as the EIAR prepared by Golder Associates to support an application made by the Applicant in 2017 to Monaghan County Council in order to continue mining operations under IEL P0519-03. The mitigation outlined within the Golder Associates 2017 EIAR include:

- Continue monitoring as per IEL P0519-03
- All haul roads to be kept clean and maintained in a good state of repair
- Heavy goods vehicles entering and leaving the existing the Site will have tailgates securely fastened; all mobile plant used will have noise emission levels that comply with relevant guidance
- Plant will be operated in a proper manner with respect to minimising noise emissions, e.g. minimisation of drop heights, no unnecessary revving of engines, plant used intermittently not left idling
- Plant will be subject to regular maintenance, i.e. all moving parts kept well lubricated, all cutting edges kept sharpened, the integrity of silencers and acoustic hoods maintained
- Plant will be fitted with effective exhaust silencers, and maintained in good working order to meet manufacturers' noise rating levels. Defective silencers will be replaced, and
- Where practicable the use of rock breaking equipment will primarily be confined to the extraction void.

This Proposed Licence Amendment does not look to alter any of the noise and vibration limits or monitoring requirements relating to noise and vibration within the existing IEL P0519-03. Annual noise monitoring suggests the mine and factory sites are compliant with the noise limits as set out in IEL P0519-03. In light of this additional mitigation measures have not been proposed as part of this EIAR.

11.6 Cumulative Impacts

This Proposed Licence Amendment does not look to alter any of the noise and vibration limits or monitoring requirements relating to noise and vibration within the existing IEL P0519-03. The Proposed Licence Amendment will not alter the existing noise environment or introduce a new noise source and as such would not create any additional noise sources to be considered in combination with other developments.

11.7 Residual Impacts

This Proposed Licence Amendment does not look to alter any of the noise and vibration limits or monitoring requirements relating to noise and vibration within the existing IEL P0519-03. No mitigation measures or residual impacts were identified.

11.8 Summary

The annual noise monitoring of the mine site in 2018 and 2019 by Nam Acoustics concluded noise levels were compliant with licence criteria at the nearest sensitive locations to the noise monitoring locations at the mine and factory sites.

This Proposed Licence Amendment does not look to alter any of the noise and vibration limits or monitoring requirements relating to noise and vibration within the existing IEL P0519-03. The Proposed Licence Amendment will not alter the existing noise environment or introduce a new noise source and as such would not create any additional noise sources to the wider environment.

The Proposed Licence Amendment relates only to an increase in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1. No additional infrastructure is required to facilitate the Proposed Licence Amendment and the Proposed Licence Amendment will not alter the surrounding noise environment.

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12 Landscape and Visual

12.1 Introduction

This chapter describes the baseline landscape and visual aspects of the mine and factory sites and surrounding areas. The chapter defines the study area, and the methodology used for developing the baseline which provides a description of the baseline environmental in relation to landscape and visual aspects.

The Proposed License Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site only. The Proposed Licence Amendment will not require any additional infrastructure to be built or any existing infrastructure to be updated. The Proposed Licence Amendment does not look to alter any landscape related requirements as outlined within IEL P0519-03 and will not introduce any additional physical changes to the factory or mine site. It has been determined a detailed landscape and visual assessment is not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

12.2 Methodology

This landscape and visual baseline has been prepared in accordance with the EPA 'Guidelines on the Information to be contained in Environmental Impact Statements, 2002', 'Advice Notes on Current Practice (in preparation of Environmental Impact Statements)', the "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA 2017).

The methodology used to assess landscape and visual impacts arising from the Proposed Licence Amendment was as follows:

- A review of the area surrounding the Proposed Licence Amendment was undertaken, which considered a 500m buffer zone around both sites
- A review of the existing EIAR (prepared by Golder Associates in 2017)
- A development plan policy review to determine landscape character and predicted change to this due to the licence amendment, and
- An EPA licence review to determine any potential landscape and / or visual impacts arising from the licence amendment.

12.2.1 Sources of Information

- The preparation of the baseline was informed by material gathered and collated from various sources, including: Draft 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports', EPA, August 2017
- 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA), 3rd Edition, 2013, Landscape Institute (UK) & IEMA
- Knocknacran Open-pit Mine, Environmental Impact Assessment. Report Number 1668466.R01.EIS.A0 submitted to Monaghan County Council (Golder Associates 2017)
- Meath County Development Plan 2013-2019 (Still Current) (MCC 2013)
- Monaghan County Development Plan 2019 – 2025 (MoCC 2019)
- National Parks and Wildlife Service (NPWS), <http://www.npws.ie/>
- Garden Surveys as part of the National Inventory of Architectural Heritage, <http://www.buildingsofireland.ie/>
- Irishtrails; <http://www.irishtrails.ie/>, and
- Ordnance Survey Ireland, 1:50,000 Discovery Mapping.

An Environmental Impact Assessment (EIA) was previously prepared by Golder Associates to support an application made by the Applicant in 2017 to Monaghan County Council in order to continue mining operations under IEL P0519-03. The EIA included a Landscape and Visual chapter prepared by Golden Associates. The

Landscape and Visual chapter referenced two previous EIS relating to the mine site which were prepared in 2003 and 2007 by Brady Shipman Martin and concurred with their assessment that the mining operations will not impact Landscape and Visual impacts (Golder Associates 2017).

12.2.2 Legislation and Guidance

The following relevant policy and legislation was considered when completing this chapter and when identifying baseline data:

Table 12-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
Meath County Development Plan 2013 - 2019	Various Policies and Objectives outlined in the Development Plan allow for the protection of Heritage including Protected Structures, National Monuments, archaeological sites on the Record of Monuments and Places, Architectural Conservation Areas, Historic Houses and Designed Landscapes, architectural sites on the National Inventory of Architectural Heritage, previously unknown archaeological sites and Industrial Heritage.
Monaghan County Development Plan 2019 – 2025	Various Policies and Objectives outlined in the Development Plan allow for the protection of Heritage including Protected Structures, National Monuments, archaeological sites on the Record of Monuments and Places, Architectural Conservation Areas, Historic Houses and Designed Landscapes, architectural sites on the National Inventory of Architectural Heritage, previously unknown archaeological sites and Industrial Heritage.
Draft 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports', EPA, August 2017;	Concentrates on the principles and associated practice of preparing EIARs. It is a statutory document that should be regarded by all relevant parties.
'Guidelines for Landscape and Visual Impact Assessment' (GLVIA), 3rd Edition, 2013, Landscape Institute (UK) & IEMA;	Provides guidance on assessing landscape and visual effects of a development on its receiving landscape. It the main guidance set by the Landscape Institute used to produce a Landscape and Visual Impact Assessment.

12.2.3 Study Area

The baseline area for Landscape and Visual considers a study area that extends 500 m from the red line boundaries of both the mine site and the factory site. The extent of these study areas was determined by the nature of the Proposed Licence Amendment which consists of a limited surface area and therefore, unlikely to impact the receiving landscape located beyond this distance.

12.2.4 Significance / Evaluation Criteria

The Proposed License Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 at the mine site only and will not require any additional infrastructure to be built or any existing infrastructure to be updated. As the Proposed License Amendment does not look to introduce any physical changes to the factory or mine site it has been determined a detailed environmental assessment was not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

12.2.5 Limitations

The baseline was based upon information produced by others and on information that was available online at the time of writing. No site walkover or viewpoint assessment has been undertaken as part of the assessment. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the landscape conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM.

12.3 Description of the Existing Environment & Baseline Information

12.3.1 The Mine Site

The Mine Site is located adjacent to the southeast of the R179 regional road within the townlands of Knocknacran, Drummond, Derrynascobe, Enagh and Derrynaglah in County Monaghan, near the border of County Cavan. The R179 runs between the settlements of Carrickmacross in County Monaghan and Kingscourt in County Cavan. The Knocknacran open-pit mine has been in operation since 1989, though historical records indicate mining of gypsum at Knocknacran as far back as 1871. The adjacent Drumgoosat mine (to the north-west) operated between 1958 and 1989. Underground mining currently (since 2005) takes place from the Drummond mine immediately to the south. Beyond the bounds of the open-pit mine and associated processing operations is an undulating drumlin landscape of predominantly pastoral farming.

This consists of modest sized fields defined by a geometric network of broadleaf hedgerows. Occasional patches of woodland, blocks of commercial conifer forest and drumlin lakes also occur within the wider area. This rural landscape is also dotted with farmsteads and rural dwellings that are served by a network of local and regional roads.

12.3.2 The Factory Site

The Factory Site is located south of the town of Kingscourt, across the Cavan County border in County Meath. The site sits along the eastern edge of the R162. The factory site is located in the townland of Boynaghbough between the settlements of Kingscourt in County Cavan and Pole in County Meath. The surrounding landscape is predominantly pastoral fields with mature hedgerows tunnelling the views along the regional road.

The fields within the study boundary of the factory site are defined by mature and well-established patchwork of broadleaf hedgerows. Similar to the Mine Site, the landscape is also dotted with farmsteads and rural dwellings that are served by a network of local and regional roads.

12.3.3 Sensitive Receptors

12.3.4 The Mine Site

Whilst the previous application was prepared under the Monaghan County Development Plan 2013 – 2019, the current relevant policy document is the newly published Monaghan County Development Plan 2019 - 2025. There does not appear to have been any significant changes to landscape and visual related designations under the current plan. There still is no Landscape Character Assessment (LaCA) for the County. There is a map identifying areas of Primary Amenity, Secondary Amenity and designated Scenic Routes. However, none of these sensitive landscape designations occur within the vicinity of the proposal site.

12.3.5 The Factory Site

The Factory site is located in the 'Hills and Upland' Landscape Character Type (LCT) as shown in (Volume 3, Appendix A.12.1, Figure A.12-1). This LaCA is described in Meath County Development Plan as being of Moderate Value and of High Sensitivity due to the many local landmarks located within this LCT. There are no designated landscape assets within the boundaries of the factory site or within the 500m study area surrounding the factory site (Volume 3, Appendix A.12.1, Figure A.12-1).

The 'Hills and Upland' LCT is described in the Meath County Development Plan as being:

“a prominent feature of the County, particularly in the north west. From the tops of these hills panoramic views of the lowland landscapes of Meath and adjacent counties are gained.”

The council recommends the following in terms of management and development of this LaCA;

- To preserve and enhance the rich heritage assets of these LCT's which provide visible evidence of all four key phases of the County's history

- To have due regard to the positive contribution that views across adjacent lowland areas and landmarks within the landscape make to the overall landscape character
- To respect the remote character and existing low-density development in these LCTs
- To implement improvements to the visitor attractions, primarily Loughcrew and the Hill of Tara
- To explore the potential to create way marked walking trails that facilitate interpretation and appreciation of historic landscape features
- To continue and encourage the improved management of field boundaries such as hedgerows and stone walls and hunting copses / wooded copses
- To maximise the potential amenity value of water bodies with this LC, and
- Facilitate the development of sustainable rural industries that encourage interaction between urban and rural landscapes and dwellers, e.g. farmer's markets.

The Landscape Character Assessment for County Meath breaks down the landscape assessment further into Landscape Character Areas (LCA's). The area which the factory site is located has been identified as 'North Meath Lakelands'. This LCAs has been assessed as being of Low Sensitivity and of Moderate Value with the development plan describing it as follows;

'The landscape character around settlements tends to be a well- managed patchwork of small pastoral fields, dense hedgerows and small areas of broadleaved woodland. In more remote areas, farmland becomes less well managed with overgrown hedgerows and less woodland. In some place's hedgerows are beginning to be replaced by post and wire fences, an indication of a decline in landscape condition. The agricultural landscape comprises a series of small farms with square – rectangular fields divided by hedgerows which are usually clipped to eye-level adjacent to road corridors but are less well managed away from roads.'

12.4 Assessment of Potential Impacts

12.4.1 The Mine Site

This Environmental Impact Assessment Report relates to the potential significant effects of a review to the site's current IEL No. P0519-03. This is to allow for an increase in the ELV for sulphate from a limit of 200 mg/L to 1,250 mg/L sulphate and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 in the River Bursk .

The Proposed Licence Amendment relates to an existing compliance point and utilises existing equipment. It will not require additional land take or construction which could potentially impact the landscape character or the viewshed of the sensitive receptors within the study area.

Additionally, the requested increase in the permitted sulphate and electrical conductivity will not alter the landscape designations located within the 1 km study area.

12.4.2 The Factory Site

The factory site is located 7.24 km to the south of the mine site. The change to the licence relates to an increase in permitted sulphate and electrical conductivity ELV at the mine site. There will be no changes to the factory site, therefore there will be no impacts on the landscape character or visual receptors within the 500 m study area extending from the boundaries of the factory site.

12.5 Mitigation Measures

It has been assessed that the Proposed Licence Amendment will not require additional land take or construction which could potentially impact physically upon sensitive visual receptors nor will it alter the landscape character located within the 500 m study area.

Given these conditions, no mitigation measures are required regarding Landscape and Visual at the mine or factory sites.

12.6 Cumulative Impacts

There are no cumulative impacts associated with the mine site or factory site.

12.7 Residual Impacts

There are no residual impacts associated with the mine site or factory site.

12.8 Summary

The baseline has determined that there is evidence of past activity within the 500 m study areas extending from the boundaries of the mine site and factory site. There are no sensitive landscape designations within the site boundary or within the study area. The sensitive visual receptors within the study area include local residents, pedestrians and road users. The factory site is located in County Meath within the Landscape Character Type identified as "Hills and Upland", which has been assessed as being of Moderate Value and High Sensitivity. The factory site is also located in Landscape Character Area identified as 'North Meath Lakelands', which has been assessed as being of Moderate Landscape Value and Low Landscape Sensitivity.

The Environmental Impact Assessment Report relates to the potential significant effects of an increase from an ELV of 200 mg/L to 1,250 mg/L for sulphate and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 in the River Bursk.

The change to the licence relates to an increase in permitted sulphate discharge at an existing compliance point utilising existing equipment.

No potential significant effects from the Proposed Licence Amendment were identified during the assessment and no potential for cumulative impact were identified.

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13 Cultural Heritage

13.1 Introduction

This chapter describes the baseline archaeological and architectural heritage (hereafter referred to as Cultural Heritage) at the mine site and the factory site. It defines the study area and the methodology used for developing the baseline providing a description of the baseline environment in relation to Cultural Heritage.

13.2 Methodology

The Proposed License Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 at the mine site only. The Proposed Licence Amendment will not require any additional infrastructure to be built or any existing infrastructure to be updated. The Proposed Licence Amendment does not look to alter any heritage related requirements as outlined within IEL P0519-03 and will not introduce any additional physical changes to the factory or mine site. As a result, it has been determined a detailed Archaeological and Cultural Heritage assessment was not required.

13.2.1 Sources of Information

The baseline data has identified all archaeological assets and architectural heritage within a defined study area of 1 km around both the mine site and factory site. The baseline also considers the setting of these heritage assets, which can be described as the surroundings in which they are experienced and appreciated.

The preparation of the baseline was informed by material gathered and collated from various sources, including:

- National Monuments Service (NMS) and Archaeological Survey of Ireland (ASI)
- National Inventory of Architectural Heritage (NIAH)
- Monaghan County Council Record of Protected Structures (RPS)
- Meath County Council RPS
- Knocknacran Open-pit Mine, Environmental Impact Assessment. Report Number 1668466.R01.EIS.A0 submitted to Monaghan County Council. (Golder Associates 2017), and
- Geological Survey of Ireland; and Online sources were also consulted including the Heritage Council of Ireland mapping.

An Environmental Impact Assessment (EIA) was previously prepared by Golder Associates to support an application made by the Applicant in 2017 to Monaghan County Council in order to continue mining operations under IEL P0519-03. The EIA included a Cultural Heritage chapter prepared by Dr Charles Mount Heritage Services. The Cultural Heritage chapter referenced two previous EIS relating to the mine site which were prepared in 2003 and 2007 by Brady Shipman Martin and concurred with their assessment that the mining operations will not impact archaeology or architecture (Golder Associates 2017).

13.2.2 Legislation and Guidance

The following relevant policy and legislation was considered when completing this chapter and when identifying baseline data.

Table 13-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
National Monuments Acts (1930 – 2004)	All monuments are protected by the National Monuments Act 1930-2004. This includes any recorded monuments located within the boundaries of the mine and the immediate vicinity.
Planning and Development Acts 2000 – 2019	The Planning and Development Act allows for the protection of the archaeological heritage and Monaghan County Council may attach conditions related to archaeology to individual planning permissions on the recommendation of the County Heritage Officer.

Legislative Policy and Guidance Description of why the Legislative Policy and Guidance is of Relevance

	These conditions must be carried out by suitably qualified archaeologists acting under licence to the Minister for Culture, Heritage and the Gaeltacht.
Planning and Development Regulations 2001 and 2019	Planning and development regulations shaping planning policy including in relation to heritage matters.
Demesnes, Estates and their Settings, An Action of the County Cork Heritage Plan 2005/2010. Cork County Council, Cork	Provides guidance on assessing impacts to the settings of heritage assets. While this has been issued by Cork County Council, it is the only settings guidance produced in RoI and is applicable to other council regions including County Monaghan. It is applicable to designated heritage assets within the boundaries of Dublin airport and the immediate vicinity.
Department of Arts, Heritage, and the Gaeltacht, 1999, Frameworks and Principles for the Protection of the Archaeological Heritage. The Stationary Office, Dublin	Statutory guidance on Frameworks and principles for the Protection of the Archaeological Heritage. This extends to archaeological heritage within the boundaries of the site and the immediate vicinity.
Department of Arts, Heritage and the Gaeltacht, 2011, Architectural Heritage Protection, Guidelines for Planning Authorities. The Stationary Office, Dublin	Guidance on the protection and treatment of architectural heritage and is applicable to architectural heritage assets.
Monaghan County Development Plan 2019 – 2025	Various Policies and Objectives outlined in the Development Plan allow for the protection of Heritage including Protected Structures, National Monuments, archaeological sites on the Record of Monuments and Places, Architectural Conservation Areas, Historic Houses and Designed Landscapes, architectural sites on the National Inventory of Architectural Heritage, previously unknown archaeological sites and Industrial Heritage.
Meath County Development Plan 2013 - 2019	Various Policies and Objectives outlined in the Development Plan allow for the protection of Heritage including Protected Structures, National Monuments, archaeological sites on the Record of Monuments and Places, Architectural Conservation Areas, Historic Houses and Designed Landscapes, architectural sites on the National Inventory of Architectural Heritage, previously unknown archaeological sites and Industrial Heritage.
IAI (2006a) Code of Conduct for Archaeological Assessment Excavation. Institute of Archaeologists of Ireland	Guidance produced by the Institute of Archaeologists of Ireland on the standards applicable to archaeological assessment excavation in Ireland. Any intrusive archaeological assessment conducted to inform this project or carried out as required mitigation should conform to these standards.
IAI (2006b) Code of Conduct for the Treatment of Archaeological Objects in the context of an archaeological excavation. Institute of Archaeologists of Ireland	Guidance produced by the Institute of Archaeologists of Ireland on the standards applicable to the treatment of archaeological objects recovered during archaeological excavation in Ireland. This guidance will apply to any artefacts recovered during intrusive archaeological assessment conducted to inform this project or carried out as required mitigation.
IAI (2007) Environmental Sampling: Guidelines for Archaeologists. Institute of Archaeologists of Ireland	Guidance produced by the Institute of Archaeologists of Ireland on the standards applicable to the sampling of environmental deposits recovered during archaeological excavation in Ireland. This guidance will apply to the sampling of environmental deposits recovered during intrusive archaeological assessment conducted to inform this project or carried out as required mitigation.

13.2.3 Study Area

The baseline data considers a study area that extends 1 km from the red line boundaries of both the mine site and the factory site. The extent of these study areas was determined by the nature of the Proposed Licence Amendment which consists of a limited surface area.

13.2.4 Significance / Evaluation Criteria

The Proposed License Amendment relates to a change in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1 at the mine site only and will not require any additional infrastructure to be built or any existing infrastructure to be updated. As the Proposed License Amendment does not look to alter any heritage monitoring requirements as outlined within IEL P0519-03 and will not introduce any physical changes to the factory or mine site it has been determined a detailed archaeological and architectural assessment was not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter

13.2.5 Limitations

The baseline is based upon information produced by others and online information available at the time of writing. No site walkover or intrusive archaeological fieldwork has been undertaken to inform the baseline. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the cultural heritage conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM

13.3 Description of the Existing Environment & Baseline Information

13.3.1 The Mine Site

13.3.1.1 Designated Heritage Assets

There are no designated heritage assets within the boundaries of the mine site. One designated asset is located within the wider 1 km study area (Volume 3, Appendix A.13.1, Figure A13-1). This is St. Molua's Church (RPS 41401301) which is a Protected Structure located 822 m to the west of the mine site. The current church building dates to 1824 and it replaced an older structure which is recorded in the ecclesiastical taxation (1302-06) of Pope Nicholas IV.

St. Molua's Church is also recorded on the Record of Monuments and Places as MO033-005001 and on the National Inventory of Architectural Heritage as NIAH 41403301. It is described as a freestanding Church of Ireland church with a two-bay nave, a three-stage square-plan tower with a later chancel and vestry added in 1891. There is a single-storey lean-to extension to the re-entrant corner of the tower and nave with further single-storey lean-to extensions at the south. The church has a pitched slate roof with stone copings with cross gable finials and cast-iron rainwater goods. The roof has a crenelated parapet and corner pinnacles to the tower.

The National Inventory of Architectural Heritage assesses St. Molua's Church to be an early nineteenth-century church, set within its own grounds occupying a pleasant site which is enhanced by its rural picturesque setting. The building has been extended over time but still retains its original character and interesting features such as its timber Y-traceried windows. The graveyard, with its early stone markers, encircles the church and is a site of historical and archaeological importance.

There are several associated undesignated heritage assets within the immediate vicinity of the church. These will be discussed in paragraph 13.3.1.2.

13.3.1.2 Undesignated Heritage Assets

There is one undesignated heritage asset located within the boundaries of the mine site with another 16 recorded within the 1 km study area (Volume 3, Appendix A.13.1, Figure A13-1). These consist of 13 archaeological assets noted on the Record of Monuments and Places (RPS) and four built assets recorded on the National Inventory of Architectural Heritage (NIAH).

The asset within the boundaries of the mine site is the rath (MO034-001) which is located 40 m to the southeast of the main mine at the south tip of a north-south orientated drumlin ridge. Rath's comprise of a strong circular earthen wall forming an enclosure and traditionally serving as defended residences for well to do farmers with larger versions occupied by tribal chiefs dating from between the Iron Age and Early Medieval periods. Although scrub-covered, the rath's enclosing bank and ditch are still discernible allowing measurement. The rath consists of a circular area with a diameter. 27 m north to south enclosed by a bank measuring between 5 m and 6.2 m wide by 1.3 m internally high at north by 2.4 m high externally. The bank is enclosed by a waterlogged ditch separated by a water-logged fosse measuring 6.6 m wide by 1.9 m deep. An outer bank is located from southeast to west to north-northeast measuring 3 m wide by 0.4 m high. This bank is believed to an agricultural feature and, therefore, non-archaeological. This asset has been enclosed by a hard fence to demarcate a 30 m buffer zone between it and any mine activities (Golder Associates 2017).

Seven of the assets noted on the Record of Monuments and Places (RMP) are associated with the Designated St Molua's Church (RPS 41401301) either being located within the church itself or the surrounding graveyard. A grave slab (MO033-005006) is located under the fitted carpet of the church aisle. This dates to 1679 and marks the grave of John Dobbs.

The church is situated within the southeast quadrant of a sub-rectangular or D-shaped graveyard (MO033-005002). The shape of this graveyard is suggestive of an ecclesiastical enclosure which would denote an early medieval date for the site. This is corroborated by archaeological testing which took place in 2005 which uncovered a ditch (MO033-005007) which may have formed part of an enclosure centred on the graveyard (McLoughlin, 2006).

The archaeological testing was carried out under licence (05E1374) in the area north to southeast outside the graveyard (MO033-005002-). The testing identified an area with redeposited soils located close to a stream which is circa 70 m to the northeast of the present church. The ditch (MO033-005007) was uncovered 15 m southeast of the graveyard wall. It measured 1.6 m wide and 0.8 m deep and was filled with silty clay at the base beneath a silty sand with charcoal inclusions. The ditch ran parallel with the graveyard boundary. A similar feature was uncovered to the northeast of the graveyard. This ditch measured 1.9 m wide by 0.6 m deep. No artefacts were recovered but iron slag was encountered over much of the area suggesting industrial activity had taken place. This would be consistent with an ecclesiastical site dating to the Early Medieval period as possibly represented by the enclosure.

During the Early Medieval period, the study area formed part of the Kingdom of Airgialla, which included the current counties of Louth, Armagh and Monaghan, which was ruled by the Ua Cerbaill family (Golder Associates, 2017). The Annals of the Four Masters (1636) outlines the history of the area during the Early Medieval period. From the early ninth century the Fear-Rois sept occupied the area of the barony of Farney (Fearnmhaighe) while from the later tenth century the Fear-Rois was ruled by the U Finn family (Golder Associates 2017). They are first noted in the Annals in 996 AD when the son of Donnchadh Finn and the Feara-Rois defeated the Ui-Meith. In 1073AD the Annals noted the death of Cuchaille Ua Finn, lord of Feara-Rois and in 1109 King Murchadh Ua Maeleachlainn of Meath plundered Feara-Rois, and Killed Ua Finn, lord of Feara-Rois.

Settlement activity from this period is well represented within the study area with four raths recorded. As mentioned, one of these raths, MO034-001, is located within the boundaries of the mine site. The next closest asset is also a rath (MO031-088) which is located 100 m to the northeast of the mine site on the gentle east facing slope of a low hill. The component earthen bank and enclosing ditch are well defined as is an entrance at southeast.

The remaining undesignated archaeological assets include another rath (MO034-003) which is 814 m to the southeast on a slight rise in marginal terrain. A cluster of three enclosures are located circa 402 m to the southwest of the mine site. Two of these assets, MO013-011 and MO013-010, are shown on the 1834 edition of the Ordnance Survey (OS) map sheet though have since been disturbed with their component parts barely discernible. The remaining enclosure (MO033-008) was noted as a cropmark on aerial photography defined by a circular ditch with an opening at southeast. The three enclosures are all small and between 10 m to 12 m in diameter which would suggest that they are not raths dating to the Early Medieval period which are generally over 30 m in diameter.

Another archaeological asset is a mound (MO031-008) which was located 818 m to the northwest of the site. It is shown on the 1834 and subsequent 1907 editions of the OS map but has since been quarried away with no traces remaining. The mound was opened in 1860 with nothing of note uncovered. The asset has been tentatively identified as a barrow dating to the Prehistoric period.

The last archaeological asset within the 1 km study area is a rath (MO033-004) which is located 995 m from the mine site at the southeast end of a relatively low northwest to southeast orientated ridge. It consists of a circular, domed (1.3 m high) and grass-covered area (diam. 50 m north to south by 47 m east to west) which is defined by an overgrown earthen bank. The bank measures 5 m wide, and 2 m high to the exterior at north while from west to north-northeast it has been reduced to a scarp measuring 3.4 m wide by 2.3 m high. There is no visible enclosing ditch while there are gaps in the perimeter at west, north-northeast and south-southwest. The gap at the south-southwest may be the original entrance.

The eight undesignated architectural heritage assets represent a range of types and periods. The closest of these to the mine site is a lime kiln (NIAH 41403303) which is located 359 m to the west of the site adjacent to the R179 road. The kiln dates to 1800 but was restored recently with some dressed, snecked new stonework added with a castellated parapet.

A farmyard complex (NIAH 41403013) is located 573 m to the northwest of the mine site. This asset dates to 1820 consisting of a three-bay, single storey vernacular house with a gabled windbreak to the south and single and two-storey outbuildings attached to the west end. The farmyard complex is typical of the vernacular tradition and adds a strong visual presence to the landscape.

A second farmyard complex (NIAH 41403302) is located 655 m to the west of the mine site. This asset dates to 1800 and consists of a four-bay, single-storey house with the remains of a windbreak with rounded walls and an

extensive range of outbuildings. The composition on plan of this asset has changed little since it was built and it is considered a notable example of a traditional farmstead arrangement.

A rectory (NIAH 41403012) is located 900 m to the west-southwest of the mine site. This is a detached three-bay, two-storey house set over a part-raised basement. The rectory was built in 1824 and it was refenestrated circa 1880. It is set back from road and is accessed by winding avenue. There are curved rubble stone walls and wrought-iron double-leaf gate at the site entrance which is located at a T-junction in road.

A Spa well (NIAH 41403402) located 988 m to the east of the mine site. It is identified on the 3rd edition OS map sheet as a chalybeate well ³²denoting that it is rich in iron salts. This would have been considered very beneficial for health. A concrete cross on a stepped base was added around 1900 in the tradition of contemporary religious practices, and it is now in use as a holy well.

The last architectural asset is a bridge (NIAH 41403406) which is located on the boundary of the 1 km to the southwest of the mine site. This asset carries the road over the River Lagan which forms the boundary between Counties Monaghan and Meath. It consists of a double-arch stone road bridge which was built in 1750. It has dressed stone V-cutwaters to both faces on concrete footings with rubble stone abutments and wing walls.

13.3.2 The Factory Site

13.3.2.1 Designated Heritage Assets

There are no Designated Heritage assets either within Factory Site or the study area extending 1km from the boundaries of the factory site (Volume 3, Appendix A.13.1, Figure A13-2).

13.3.2.2 Undesignated Heritage Assets

There are no undesignated heritage assets within the boundaries of the factory site however 16 occur within the 1km study area surrounding the factory site (Volume 3, Appendix A.13.1, Figure A13-2).

The majority of these assets are associated with the Early Medieval period with one asset is classified as an enclosure (ME002-060). It is currently unclear what period this asset relates to as it consists of a D-shaped enclosure located on the southwest facing slope of a drumlin 300 m to the east of the factory site. There are no upstanding remains of the enclosure which was identified from an aerial photograph. It measures 80 m east to west by 50 m north to south. The northeast angle of the enclosure is accommodated by a niche in a northwest to southeast aligned field bank which suggests that the enclosure was upstanding when the field bank was constructed. The line of a gas pipeline crosses through the enclosure to the factory site. No evidence for the enclosure was uncovered during the laying of the pipeline.

The closest recorded monument to the factory site is a rath (ME002-053) located 100 m east of the factory site on a fairly steep southwest facing slope. It consists of a subcircular grass and scrub-covered area measuring 53 m north to south by; 47 m east to west. The interior is defined by an overgrown earthen bank which measures 5.6 m by 2.8 m high above the exterior. The bank is largely enclosed by a water-logged ditch measuring 2.8 m wide by 0.6 m deep except between north to northeast where it is missing. The original entrance is located at south-southwest and measures 2.2 m wide. A 3.6 m wide causeway provides access to the entrance over the ditch. The rath is surrounded from south-southwest to northwest to northeast by an outer field bank.

Other notable assets in the study area include the rath (ME002-029), rath (ME002-031) and rath (ME002-055). Each of these has an associated structural feature. The rath (ME002-029) is located 600 m to the northwest of the factory site on the southeast facing slope of an east to west orientated drumlin ridge. It consists of an area 32 m in diameter which is enclosed by a bank measuring 5 m wide by 2.4 m at its highest point. The bank is enclosed by a ditch 7.5 m at its widest point by 0.4 m at its highest point. The majority of the ditch has been removed with the result it is only visible southeast to south and west to northwest. A rectangular grass covered area measuring 5.9 m north-northwest to south-southeast by 2.7 m wide is defined by low banks 2.3 m wide and 0.5 m high within the east-northeast of the interior of the rath. The feature has been identified as a house (ME002-029001).

The rath (ME002-031) also has an associated house structure (ME002-031001). This rath is located 900 m to the northeast of the factory site on top of a broad hill. It is represented as a D-shaped feature on the northwest side of a northeast to southwest orientated field bank on the 1st edition OS map (1836) and 2nd edition OS map (1908). The rath consists of a raised D-shaped grass-covered area measuring 29 m northeast to southwest by; 20 m northwest to southeast defined by a slight bank measuring 7 m by 1.6 m at its highest point. An external ditch

³² A Chalybeate well contains natural spring water containing salts of iron which are considered beneficial to health. People would have formerly visited the well to drink the spring waters for medicinal reasons.

measuring 2.5 m wide by 0.8 m high is apparent from northwest to northeast. A northeast to southwest orientated field bank truncates the asset towards the perimeter at southeast and it does not survive visibly beyond it. The grass-covered foundations of a rectangular house (ME002-031001) 7.5 m northeast to southwest by-SW 4.8 m wide is located within the northwest of the interior. The area of the house is defined by a defined by a spread of stone 1.3 m wide by 1 m high.

The rath (ME002-055) is located 900 m to the east of the factory just southeast of the summit of a northwest to southeast ridge. The rath consists of a circular overgrown area 31 m in diameter that slopes down to the south. It is defined by an overgrown earthen bank measuring 5.2 m wide by 2.7 m at its highest point. The bank is enclosed by a ditch 8 m wide by 1.4 m deep. The entrance is 2 m wide and located at the east south-east.

There is a sub rectangular or lunate annexe (ME002-005001) attached to the south of the rath. It measures 20 m north to south by 50 m east to west and is defined by slight banks measuring 1 m wide by 1.5 m high. A slight ditch is evident on the west side and the annexe has a 2.8 m wide entrance at the southeast. There is no direct communication between the rath and the annexe.

The remaining assets within the study area are listed in Table 13-2.

Table 13-2 Remaining heritage assets within 1 km study area around the factory site

RMP Number	Type	Location	Description	Distance from Project
ME002-030	Rath	Raloaghan	Located towards the top of the W-facing slope of a hill and just above its steepest point. This is a circular grass and scrub-covered area (diam. 37 m NE-SW; 34 m NW-SE) that slopes down to the W defined by an overgrown earthen bank (at NE: Width of base 5.6 m; int. H 1.3 m; ext. H 2.2 m) N-E-SW that is reduced to a scarp (at NW: Width 5 m; H 2.7 m) elsewhere. There is an outer fosse (Width of top 7-10 m; Width of base 3 m; ext. D 1.5 m) and an outer bank (at SE: Width of base 4.1 m; int. H 1.5 m; ext. H 0.5 m) NE-E-SW, with traces of the fosse elsewhere. The entrance through the inner (Width of base 1.7 m) and outer (Width of base 1.8 m) banks with a causeway (Width of top 3 m; H 0.7 m) is at SSW.	600 m to northeast
ME002-045	Rath	Aghafarnan	Located towards the top of the SSE-facing spine of a N-S ridge. In 1969 this was a circular grass and scrub-covered area (diam. 34 m NNW-SSE 32 m NE-SW) defined by a wide and overgrown earthen bank (Width of base 7.5-10.8 m; int. H 0.8 m at SW to 2.2 m at NE; ext. H 2.5-2.9 m) separated by an outer fosse (Width of base 1.5-2.7 m; ext. D 0.6 m at SW to 1.4 m at NE) from an outer bank (at SW: Width of base 4 m; ext. H 0.5 m) that was incorporated into a field bank (Width of base 2.7 m; int. H 1.4 m; ext. H 0.5 m) N-E. The entrance (Width of base 1.5 m) was at SE where the fosse was less pronounced. The visible monument had been removed by 1995.	600 m to west
ME002-046	Rath	Lisnagrow	Located on a bluff that is on a SW-facing slope overlooking the wooded Milltown Glen and its NW-SE stream which are immediately to the SW. It is described as 'Rockey's Fort' in gothic lettering on the OS 6-inch maps. In 1969 this was a raised subcircular and grass-covered area (dims 50 m NW-SE; 42.4 m NE-SW) defined by an overgrown earthen bank that backs onto the slope of the glen (H 5 m) S-W, with an outer fosse (Width of top 4 m; Width of base 2.5 m; ext. D 1 m) and outer bank (Width of base 3.2 m; ext. H 0.5 m) W-NW. The entrance (Width of base 2.5 m) was at SE. The visible monument had been removed by 1995.	630 m southeast
ME002-047	Rath	Keenaghan	Situated on a short NW-SE spur that is towards the top of an E-facing slope with the stream of the wooded NW-SE Milltown Glen circa 110 m to the NE. It is described as 'Leary's Fort' in gothic lettering on the OS 6-inch maps. This is a subcircular grass-covered area (dims 33.5 m NE-SW; 28 m NW-SE) defined by an earthen bank (Width of base 4.9-6.2 m; int. H 0.2-0.3 m; ext. H 1.3 m at NNE to 2.3 m at SSW) and hedge. There is no visible fosse and the entrance ramp (Width of base 1.4 m) is at SSE. It has become overgrown since 1968.	600 m southwest
ME002-048	Rath	Keenaghan	Located towards the top of the E-facing spine of a W-E spur. This is a raised, circular and grass-covered area (diam. 40.5 m N-S; 36 m E-W) that slopes down slightly to the S (H 1 m). It is defined by an earthen bank (Width of base 5.7-7 m; int. H 0.4-0.7 m; ext. H 1.3-1.5 m) and hedge that is reduced to a scarp SW-WNW. There is no visible fosse and the entrance (Width of base 2.9 m) is at E.	998 m south

RMP Number	Type	Location	Description	Distance from Project
ME002-049	Rath	Keenaghan	Located on a shoulder of an E-facing slope. It is not recorded on any edition of the OS 6-inch map, but it is regarded locally as a rath and there is known to be a change in soil quality in its vicinity. This is a D-shaped grass-covered area (dims circa 50 m ENE-WSW; circa 25 m N-S) defined by a slight scarp ENE-S-WSW. It is truncated by an ENE-WSW field bank at N and is not evident in the field to the N.	900 m southwest
ME002-051	Rath	Keenaghan	"Located at the outer edge of a shelf and at the crest of an E-facing slope. This is a circular grass-covered area (diam. 34 m N-S; 31 m E-W) that slopes down to the E (H 1 m). It is defined by a slight earthen bank (at WNW: Width of base 7 m; int. H 0.2 m; ext. H 0.3 m) that is largely reduced to a scarp (at ESE: Width 2.5 m; H 1.4 m) with some bushes. There are slight traces of a fosse (ext. D circa 0.1-0.2 m) W-N, and the original entrance (Width of base 2.1 m) is at SSW. Short field banks connect the perimeter at WSW and NNW to a N-S road bank circa 5-10 m distant.	920 m south
ME002-054	Rath	Raloaghan	Located just SE of the summit of a NW-SE drumlin ridge. This is a circular grass and scrub-covered area (diam. 37.4 m E-W; 36.2 m N-S) that slopes down to the SE defined by an overgrown earthen bank (at NNW: Width of base 7 m; int. H 1.6 m; ext. H 1.7 m) that has a field bank with an outer stone facing abutting its external face SE-W-NW. There is no visible fosse but there is an outer drain. There are gaps in the perimeter at NNE and E, but the original entrance is likely to be a widened entrance (Width 5 m) at SE.	500 m to east

13.3.2.3 Previous Archaeological Work

No previous archaeological work has taken place within either the mine site or the factory site according to the Database of Irish Excavations (Excavations.ie). The only recorded archaeological work within the 1 km study area around the mine site took place in 2006 near St. Molua's church (MO033-005) under licence 05E1374. This investigation has been discussed in 13.3.1.2.

The only recorded archaeological investigation within the 1 km study area around the factory site took place at Ballynaclose, 300 m to the northwest, in 2012. It related to Phase 2 of a Water Conservation Scheme within County Meath which involved the replacement of circa 15.4 km of existing watermain in various locations throughout the county (Quinn, 2011). As part of the predevelopment phase the Ballynaclose section of the scheme was the subject of an Archaeological Assessment undertaken by Byrne Mullins and Associates in 2009. Following consultation with the National Monuments Service, mitigation was agreed that the proposed works be regularly inspected by a suitably qualified archaeologist.

The works included the laying of pipes along the grass verges either side of the R162 road. Regular inspections of this work under licence 11E0130 noted that the verges had been previously disturbed by roadworks and services. Nothing of archaeological significance was uncovered.

13.3.2.4 Historic Cartographic Evidence

The 1st edition OS map (1836) shows the areas of the mine site and the factory site during the first half of the 19th century (map not reproduced). The future location of the mine site is shown as fields and marginal ground. The boundaries of the fields are straight and there are no indications of possible archaeological features within the mine site. The surrounding road network is extant at this time including the R179 which bounds the mine site to the west. Laneways extend southeast from the R179 across the area of the mine site. These provide access to scattered dwellings. The surrounding raths and enclosures are all shown on this map edition with the exception of the enclosure (MO033-008). The protected structure, St. Molua's Church (41401301) is identified as a church but the associated headstones and enclosure are not marked. The base of a tower is labelled within the graveyard which may relate to the earlier church which was replaced in 1824 with the current building. The surrounding NIAH assets are all shown.

The location of the factory site is shown as fields bounded to the west by the R162. No features are marked within these fields and there are no indications of possible archaeological assets within the location of the factory site. The majority of the recorded raths and enclosures are shown and labelled as *Fort*. The exceptions to this are the rath (ME002-049) and the enclosure (ME002-060) though this not surprising. The description of the rath (ME002-049) states that it is not marked on OS map editions while the enclosure (ME002-060) was identified from an aerial photograph. The niche in the field boundary, which respects the enclosure, is visible.

The 2nd edition OS map (1909) shows the areas of the mine site and factory site at the start of the 20th century and 73 years after the previous map sheet (map not reproduced). The location of the mine site is still shown as fields and marginal ground. The majority of the surrounding raths are now denuded while the enclosures are no longer shown. St. Molua's Church (41401301) is clearly marked within its graveyard but the base of the tower is no longer shown. The surrounding NIAH assets are all shown.

The location of the factory site is still largely agricultural ground although the Midland Great Western Railway (MGWR) railway line has now been constructed and crosses the site. The surrounding archaeological sites are still marked although all are greatly denuded.

13.3.2.5 Aerial Photographic Evidence

The orthophotograph (<https://heritagemaps.ie/WebApps/HeritageMaps/index.html>) taken in 1995 shows the layout of the mine site and factory site 25 years ago in black and white (image not reproduced). Both sites were extant at that time. The mine site is shown as mostly occupied by the mine itself with buildings located to the southeast. The majority of the mine site appears disturbed although grassed areas are apparent within its north and southwest extents. There are no visible cropmarks which could indicate the presence of subsurface archaeological features within these grassed areas.

Several of the archaeological assets are clearly visible including the rath (MO034-001) which appears as a heavily overgrown circular feature located immediately adjacent to the east of the main mine. The factory site is also largely developed although there are grassed areas within the south and east extents. Some grass is also located within the north extent although areas of disturbance are also apparent. There are no visible cropmarks which could indicate the presence of subsurface archaeological features within these grassed areas.

The archaeological assets within the area are all visible especially those within the immediate vicinity of the factory site. The rath (ME02-053) is the closest recorded archaeological asset which is visible as a circular feature covered in vegetation. It is located to the east of the factory site with the local road in between. The line of the local road respects the boundary of the rath. Also visible is the enclosure (ME002-060) located to the southeast of the factory site. This asset consists of a circular cropmark which is clearly visible within the field surface.

The orthophotograph (<https://heritagemaps.ie/WebApps/HeritageMaps/index.html>) taken in 2000 shows the layout of both sites five years after the previous orthograph (image not reproduced). This orthophotograph was taken in colour and shows both sites in good definition. There is little change at the mine site from the layout shown on the orthophotograph taken in 1995. The grassed areas are still extant although that at the southwest of the site appears possibly disturbed. The grassed area at the north of the site appears undisturbed but it is very marginal ground. The archaeological assets within the immediate vicinity are clearly visible.

The factory site also appears largely unchanged. The colour photography shows the grassed areas to consist of agricultural fields. No cropmarks are visible within these fields. The recorded archaeological assets are still visible although the cropmark defining the enclosure (ME002-60) is less apparent, being barely visible.

The orthophotograph (<https://heritagemaps.ie/WebApps/HeritageMaps/index.html>) taken in 2005 shows the layout of both sites five years after the previous orthograph (image not reproduced). The mine site shows some change with the mine extended into the grassed area noted within the north of the site on the previous orthophotographs. The remaining grassed area still appears marginal. The adjacent archaeological assets are still apparent although the rath (MO031-088) appears denuded on its north extent.

The factory site appears largely unchanged from the previous orthophotograph. The cropmark defining the enclosure (ME002-60) is not visible on this orthophotograph.

The Digital Globe aerial photograph (<https://heritagemaps.ie/WebApps/HeritageMaps/index.html>) shows the up to date layout of both sites (image not reproduced). The mine site is shown in very clear definition. The mine has now expanded to the north, west and south and the sides of the pit are clearly terraced. The grassed area at north has been stripped with the ground within the entire site now clearly disturbed. The archaeological assets within the immediate vicinity are still visible as heavily overgrown circular areas.

The factory site is unchanged with the factory clearly a very modern complex occupying the majority of the site boundary. The fields are still extant to the east, south and north. As with the previous map editions, no cropmarks are visible within these fields. The archaeological assets within the immediate vicinity are still visible with the exception of the enclosure (ME002-060).

13.3.3 Sensitive Receptors

13.3.3.1 The Mine Site

The baseline has determined that there is one sensitive receptor located within the boundaries of the mine site. This is the rath (MO034-001) which is located to the east of the main mine. This asset is preserved within the mine site and is demarcated by a 30 m buffer zone defined by a fence to protect against accidental encroachment or damage by mine activities.

13.3.3.2 The Factory Site

The baseline has determined that there are no sensitive receptors located within the boundaries of the factory site in the form of recorded heritage assets.

13.4 Assessment of Potential Impacts

13.4.1 The Mine Site

This Environmental Impact Assessment Report relates to the potential significant effects of a review to the site's current IEL No. P0519-03. This is to allow for an ELV increase from 200 mg/L to 1,250 mg/L for sulphate and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-in the River Bursk 1.

The Proposed Licence Amendment relates to an existing compliance point utilising existing equipment. It will not require additional land take or construction which could potentially impact physically upon recorded or previously unrecorded heritage assets.

Additionally, the Proposed Licence Amendment will not alter the settings of the recorded heritage assets located within the 1 km study area.

13.4.2 The Factory Site

The factory site is located 7.24 km to the south of the mine site. The change to the licence relates to an increase in permitted sulphate discharge at the mine site. There will be no changes to the factory site. There will be no impacts to the heritage assets within the 1 km study area extending from the boundaries of the factory site.

13.5 Mitigation Measures

13.5.1 The Mine Site

The Proposed Licence Amendment relates to an existing compliance point utilising existing equipment. It has been assessed that this will not require additional land take or construction which could potentially impact physically upon recorded or previously unrecorded heritage assets nor will it alter the settings of recorded heritage assets located within the 1 km study area.

Given these conditions, no mitigation measures are required regarding Cultural Heritage at the mine site.

13.5.2 The Factory Site

The Proposed Licence Amendment relates to the mine site only. The heritage assets within the 1 km study area will not be impacted.

Given these conditions, no mitigation measures are required regarding Cultural Heritage at the factory site.

13.6 Cumulative Impacts

13.6.1 The Mine Site & The Factory Site

There are no cumulative impacts associated with the mine site or factory site.

13.7 Residual Impacts

13.7.1 The Mine Site & The Factory Site

There are no residual impacts associated with the mine site or factory site.

13.8 Summary

The baseline has determined that there is evidence of past activity within the 1 km study areas extending from the boundaries of the mine site and factory site. This evidence consists of recorded archaeological assets with the majority dating to the Early Medieval period. One asset, rath (MO034-001), is located within the red line boundary of the mine site. This asset is preserved within the mine site with a 30 m buffer established to protect it against accidental damage. There are no heritage assets within the boundaries of the factory site.

The Environmental Impact Assessment Report relates to the potential significant effects of an increase in ELV of 200 mg/L to 1,250 mg/L for sulphate and from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ for electrical conductivity at Compliance Point CP-1 in the River Bursk and utilises existing equipment.

No potential significant effects from the Proposed Licence Amendment were identified during the assessment and no potential for cumulative impact were identified.

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14 Material Assets

14.1 Introduction

The Material Assets chapter evaluates potential effects the Proposed Licence Amendment may have on Material Assets. The draft 'Guidelines on the information to be contained in an Environmental Impact Assessment Reports' (EPA, 2017) describes material assets to be taken to mean '*built services*' (i.e. utilities networks including electricity, telecommunications, gas, water supply and sewerage), '*waste management*' (covered in Chapter 15 Waste) and '*infrastructure*' (i.e. roads and traffic; covered in Chapter 04 Traffic and Transport). This chapter therefore considers the potential impacts of the Proposed Licence Amendment on built services.

This chapter considers the following assets of the mine and factory sites under the existing environment & baseline information:

- Utilities
 - Electricity Network
 - Telecommunications (including phone and broadband)
 - Gas Distribution Networks
 - Water supply networks
 - Sewerage networks, and
- Land Use and Property (agricultural and non-agricultural): which considers housing, ownership, severance, loss or rights of way or amenities, or other changes likely to alter the character and use of the surroundings.

As the Proposed License Amendment does not alter utilities at the mine or factory sites; will not require the acquisition of lands, demolition or development on any lands or properties; will not require any update to existing utilities and existing infrastructure; and will not impact land use or properties, it has been determined a detailed material assets assessment is not required, however an environmental baseline was established.

14.2 Methodology

An environmental baseline was established by a desktop assessment using information freely available online on the EPA licensing web portal and any addition information provided by the Applicant. As noted in section 14.1, the license does not propose to alter any of the listed items and therefore it has been determined a detailed environmental assessment was not required.

14.2.1 Sources of Information

- Saint-Gobain Construction Products (Ireland) – P0519-03. Landfill Closure, Restoration and Aftercare Management Plan (CRAMP) – 2018 Update. RPS (2018)
- Environmental Liabilities Risk Assessment. (Factory site; KD Environmental Ltd 2018), and
- KD Environmental Ltd (2019). Environmental Liabilities Risk Assessment. (Mine site; KD Environmental Ltd.2019).

14.2.2 Legislation and Guidance

The following relevant policy and legislation has informed the scope for the impact assessment:

Table 14-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed in an EIAR, this includes material assets
S.I. No. 296 of 2018, European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	Directive 2014/52/EU is transposed into Irish Law under S.I. No 296. The Regulations describes the EIA process and lists material assets as a factor to be contained in an EIAR

14.2.3 Study Area

The study area for the built services assessment was limited to all utilities within the mine and factory site boundary.

14.2.4 Significance / Evaluation Criteria

As stated above, the Proposed License Amendment does not require a detailed material assets assessment and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

14.2.5 Limitations in the Methodology and Gaps in Information

The information contained within this chapter was based upon information produced by others and available on the EPA licensing web portal. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM.

14.3 Description of the Existing Environment & Baseline Information

14.3.1 The Mine Site

14.3.1.1 Electricity Supply

The mine site is connected to the ESB grid through an onsite medium voltage substation which connects to the overhead lines to the south of the mine site by an underground line. Overhead 400V/230V and 10KV/20KV overhead lines are located to the north of Knocknacran mine on the opposite side of the R179. A 10KV/20KV MV and 400V/230V LV underground cable is located to the south of the mine site at the mill area.

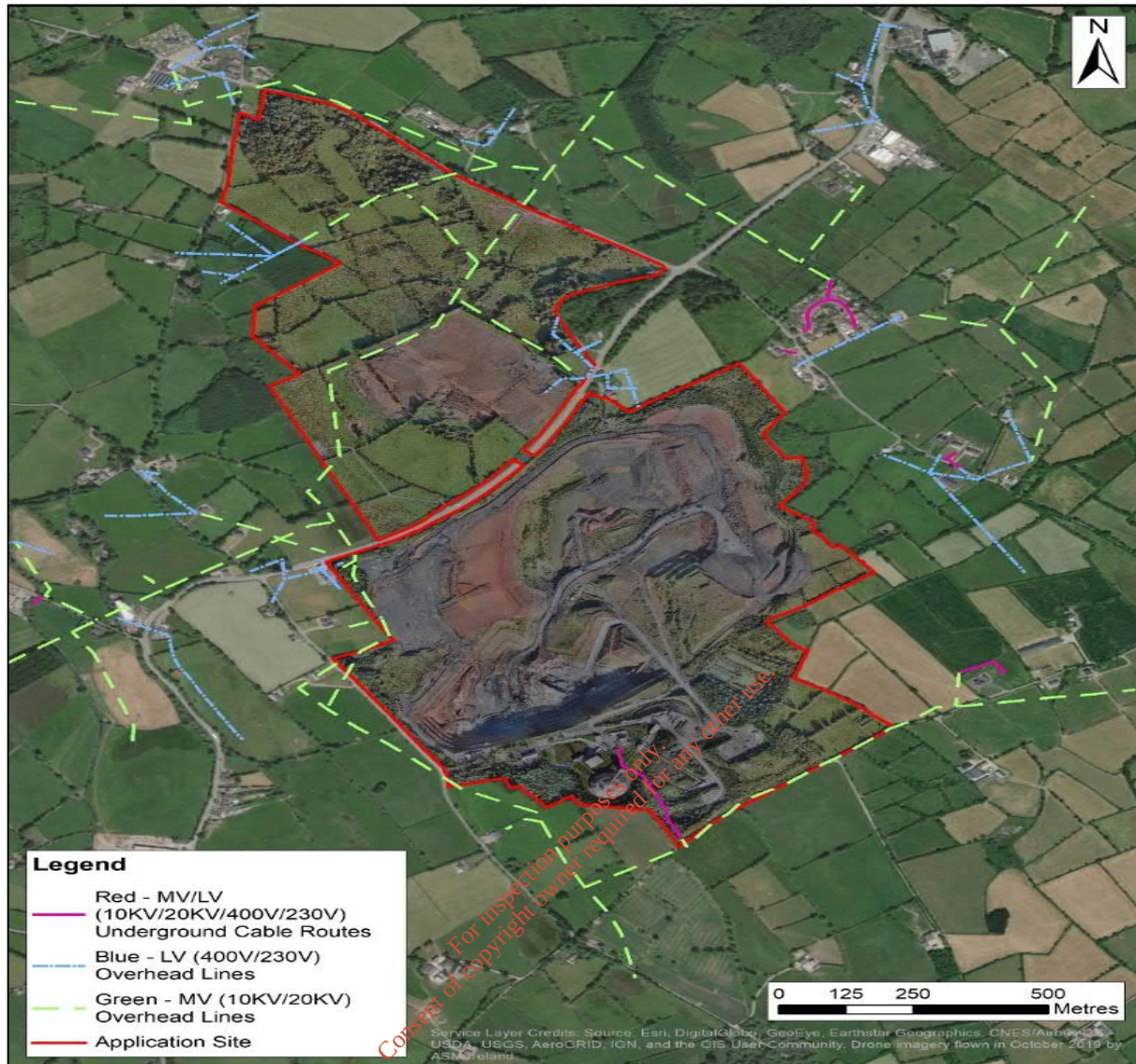


Figure 14-1 ESB Network Map, Provided by the Applicant

14.3.1.2 Gas Supply

A Gas Networks Ireland (GNI) 315 PE 4 bar distribution pipeline runs along the R179 to the north of Knocknacran mine. The distribution pipeline services the surrounding area Figure 14-2 identifies the location of the pipeline as provided by GNI, however the section of this map where the pipeline enters the open pit quarry is known to be incorrect and requires updating. Figure 14-2 suggest a section of the pipeline crossed the open pit mine however the pipeline was never encountered. In the early 2000s the Magheracloone Group Water Scheme (MWGS) encountered a gas line along the current R179 alignment. MWGS believe the gas line runs parallel to their own line along the R179. It is expected the pipeline runs along the current R179 however further investigations are required in the future to confirm its exact location.



Figure 14-2 Gas Services Plan, Provided by the Applicant

14.3.1.3 Telecommunications Network

Telecommunication overhead and underground services extend from infrastructure which tracks the existing road network surrounding the mine site. These overhead and underground services also service residential dwellings along the road network. The exact locations of telecommunication services along the R179 is unknown, they are believed to follow the existing R179 and not the previous alignment of the road.

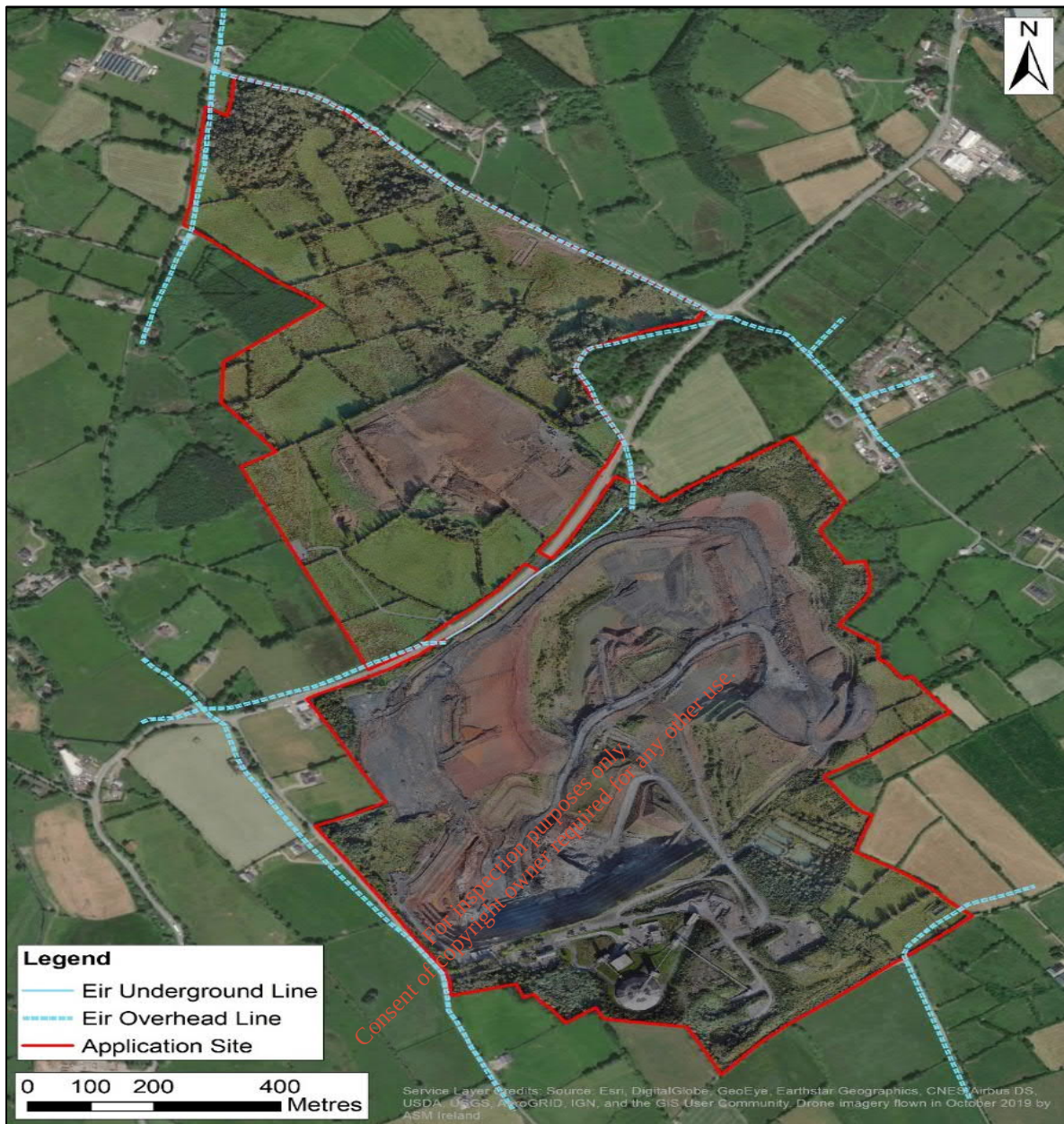


Figure 14-3 Telecommunications Network, Provided by the Applicant

14.3.1.4 Water Supply

14.3.1.4.1 Magheracloone Group Water Scheme

Magheracloone Group Water Scheme is the main water service provider in the area comprising a circa 132 km long distribution network. The primary source of water for the scheme is Lough Greaghlongne and the scheme supplies local residential swellings, churches, farms, schools and businesses as well as Knocknacran and Drummond Mines. A number of Magheracloone Group Water Scheme pipelines occur along the existing road network surrounding the mine site.

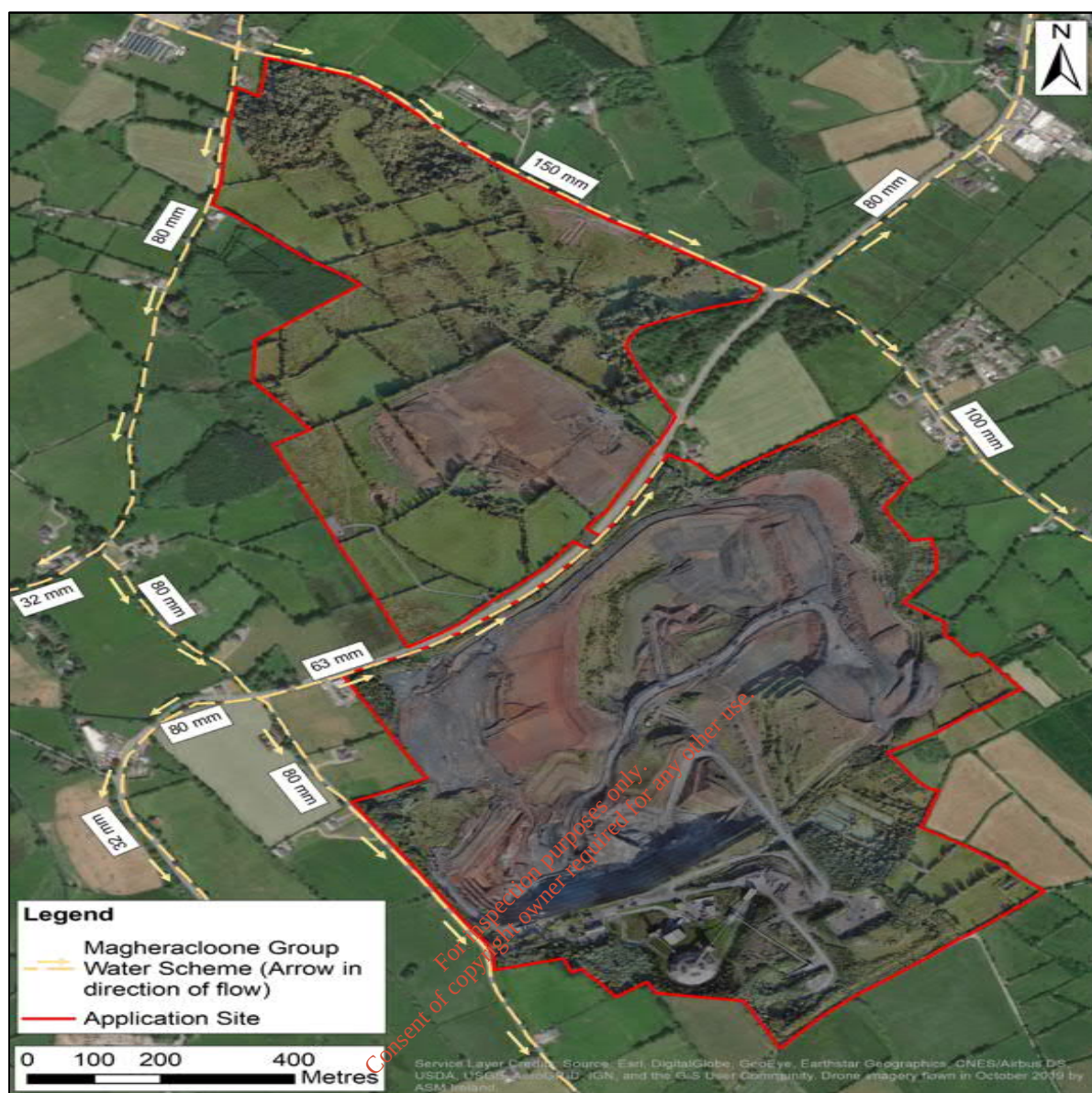


Figure 14-4 Magheracloone Group Water Scheme Pipelines, Provided by the Applicant

14.3.1.4.2 Third Party Well Network

Information identified by the Applicant noted a number of third party wells during a survey carried out in September 2019. The survey focused on an area within 200 m of Drummond Mine. Wells were identified to the north, south and west of Drummond Mine. Wells identified were used as domestic supplies, agricultural supplies, backup supplies or are not in use.

AECOM undertook a search of the GSI database for known groundwater wells within a 3 km downgradient radius of the mine site. The registered wells, types and accuracy are presented on Volume 3, Appendix A.8.1, Figure A8-3. The mine site contains 14 groundwater monitoring wells for periodic monitoring events in accordance with the EPA licence P0519-03.

Additional information on wells and groundwater usage is discussed in Chapter 8 Hydrology and Hydrogeology.



Figure 14-5 Third Party Wells Within 500 m of Drummond Mine, Provided by the Applicant

The water surrounding the mine site is provided predominately by Magheracloone Group Water Scheme and Third Party Wells. Irish Water services a small area along the R179 toward Kingscourt to the west of Knocknacran Mine.

14.3.1.5 Wastewater Infrastructure

Wastewater infrastructure at the mine site, including office areas comprises an independent septic tank system.

14.3.1.6 Surface Water Infrastructure

Where surface water occurs at the Knocknacran Mine it is directed toward the base of the open-pit mine and transferred to water settlement lagoons. Run-off from around the workshop area is directed to a hydrocarbon separator prior to pumping into the settlement lagoons.

A number of surface water monitoring points are present up and down gradient of the mine site including at the IE emissions point, and compliance point.

The mine site contains developed infrastructure to manage potential contamination to soil, surface water and groundwater receptors onsite to avoid potential contamination. As part of the licence requirements the mine site must undertake integrity testing on bunds, containment structures, underground structures including pipelines and sumps on a three-year basis with frequent visual inspections.

14.3.1.7 Land Use and Property

The environs surrounding the mine site can be described as predominantly rural in nature with land use generally being agricultural with areas of small commercial and residential dwellings. Kingscourt town is located to the south of the mine site (circa 3.9 km south). Residential properties predominately occur in linear ribbon settlements along

existing road infrastructure. The mine site is predominately an area of extraction and processing of gypsum with small areas of hardstanding. Corine Land Cover (2018) classifies the open-pit quarry as 'Artificial Surface' described as mines, dumps and construction sites. The surrounding environs are predominantly classified as 'Agricultural Areas' described as pastures.

Buildings and structures within the mine site boundary include (KD Environmental Ltd 2019):

- Offices / Administration
- Workshop Garage
- Laboratory (with Admin building)
- Car park
- Rock shed
- Homogeniser building
- Primary and secondary buildings
- Sample tower
- Emergency station (mine rescue)
- Surface water lagoons, and
- Surface water holding tanks.

14.3.2 The Factory Site

14.3.2.1 Electricity Supply

Two 125 HV ESB conduits are situated to the west of the decommissioned / capped landfill and a 125 mm ESB duct is located to the south of the decommissioned / capped landfill. Within the wider environs a 220 KV overhead transmission line is located to the north of the factory site between Lisnagrew and Kingscourt.

Detailed information on the electricity supply for the factory site was not available at the time of writing, however this information is provided as baseline information only and does not affect the consideration of potential impacts of the Proposed Licence Amendment.

14.3.2.2 Gas Supply

A Bord Gáis gas transmission pipeline is located adjacent to the factory site. A main gas supply pipeline runs to the board plant dryer. Gas supply can be shut off at different points along the pipeline (KD Environmental Ltd 2018).

Detailed information on the gas supply for the factory site was not available at the time of writing, however this information is provided as baseline information only and does not affect the consideration of potential impacts of the Proposed Licence Amendment.

14.3.2.3 Telecommunications Network

There are a number of telecommunication lines located within the site boundary for both telephone and broadband services including:

- CCTV cables
- Telephone cables, and
- Fibre optic cables.

Detailed information on the telecommunications network for the factory site was not available at the time of writing, however this information is provided as baseline information only and does not affect the consideration of potential impacts of the Proposed Licence Amendment.

14.3.2.4 Water Supply

An abstraction point for water is located at S1 Milltown Stream Reservoir, the primary use is for 'Industrial Other Manufacturing', it provides in conjunction with the onsite lagoons the main water supply for the production plant at the factory site. Irish water mains supply all offices on site, toilets, and the canteen on site. The mains are located at the front gate to the factory site.

A 100 mm uPVC water distribution pipeline is located along the R162 to the west of the factory site and a 50 mm uPVC pipeline is located to the east of the factory site (Donegal County Council Mapper 2020).

14.3.2.4.1 Third Part Well Network

The factory site contains 15 groundwater monitoring wells for periodic monitoring events in accordance with the EPA licence P0519-03.

AECOM undertook a search of the GSI database for known groundwater wells within a 3 km radius of the factory site. The registered wells, types and accuracy are presented on Volume 3, Appendix A.8.1, Figure A8-4. Additional information on wells and groundwater usage is discussed in Chapter 8 Hydrology and Hydrogeology.

The GSI database of wells is not complete as there is no legal requirement to register wells. Due to the rural nature of the mine site it is considered likely groundwater wells within the area are used for agricultural and domestic purposes.

14.3.2.5 Wastewater Infrastructure

A hydro international biological treatment system waste water treatment plant was installed at the factory site in 2006. The Wastewater Treatment Plant (WWTP) treats raw sewage at the factory site through the use of physical and biological treatment prior to discharge to a percolation area (RPS 2018; further information available in BioCore Environmental 2012). AECOM understands the WWTP is located to the south of the decommissioned / capped landfill.

A lagoon system is in place for the treatment of leachate from the capped / decommissioned landfill. Four lagoons are located to the north of the landfill area, a leachate interceptor drain has been installed around the perimeter of the landfill and all leachate within this drain is directed to the leachate lagoons (RPS 2018). The leachate is collected from the north western edge of the landfill where it decants sequentially through ponds 1 to 3, from pond 3 the leachate is then pumped to pond 4 (RPS 2018). From here water is released to the adjacent stream.

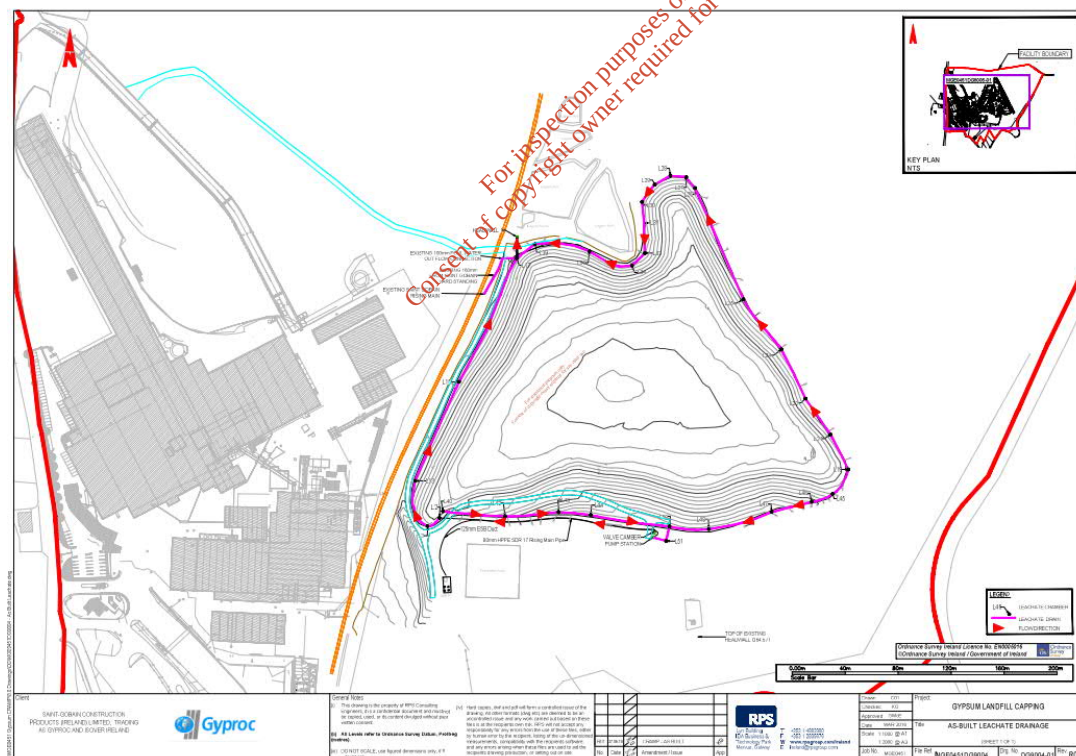


Figure 14-6 Leachate Drainage Around the Capped Landfill (RPS 2018)

14.3.2.7 Land Use and Property

The environs surrounding the factory site can be described as predominantly rural in nature with land use generally being agricultural with areas of small commercial and residential dwellings. Kingscourt town is located to the north of the factory site (circa 3 km north). Residential properties occur along existing road infrastructure such as the R162 and along local roads in the environs surrounding the factory site. The factory site includes areas of hardstanding, a capped / decommissioned landfill, manufacturing and processing buildings and storage areas. Corine Land Cover (2018) classifies factory site as 'Artificial Surface' described as mines, dumps and construction sites. The surrounding environs are predominantly classified as 'Agricultural Areas' described as pastures.

Buildings and structures within the factory site boundary include (KD Environmental Ltd 2018):

- Plaster mill manufacturing building with single story warehouse and raw material store
- Board Plant building and adjoining amenities building (cloakroom and meeting room)
- Mechanical and electrical workshop
- Accessories and engineering stores
- Office / admin building
- Technical Academy
- Rock intake
- Heavy machinery store

14.3.3 Sensitive Receptors

The sensitivity of the existing environment can be determined by describing changes to the environment that could limit the access to, or use of, the material asset (EPA 2003). The sensitive receptors are regarded as the existing utilities networks infrastructure at the mine site and the factory site however the Proposed Licence Amendment does not look to alter and will not impact upon the existing utilities networks infrastructure at either site.

14.4 Assessment of Potential Impacts / Comments on Monitoring Results

As the Proposed License Amendment does not alter any utilities at the mine or factory sites, will not require the acquisition of lands, the demolition of or development on any lands or properties, will not require any update to existing utilities and existing infrastructure and will not impact land use or properties. In light of this a detailed assessment of impacts to utilities has not been carried out.

14.5 Mitigation Measures

No mitigation measures were identified beyond those already carried out onsite. Monitoring and reporting of results to the EPA such as pipeline inspections will continue as outlined within IEL P0519-03.

14.6 Cumulative Impacts

The Proposed Licence Amendment is not expected to add to cumulative demand for capacity for utilities, lands or properties with other developments within the wider environs.

14.7 Residual Impacts

No residual impacts were identified.

14.8 Summary

This Proposed Licence Amendment does not alter any utilities at the mine or factory sites, will not require the acquisition of lands, the demolition of or development on any lands or properties, will not require any update to existing utilities and existing infrastructure and will not impact existing land use or properties. The Proposed Licence Amendment relates only to an increase in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1. No additional infrastructure is required to facilitate the Proposed Licence Amendment. No mitigation measures, cumulative impacts or residual impacts were identified.

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15 Waste

15.1 Introduction

The waste chapter considers the potential effects the Proposed Licence Amendment may have on waste. It identifies the study area, the methodology used for developing the baseline, and provides a description of the baseline environment.

For the purpose of this EIAR, waste is defined as per the Waste Framework Directive (EU, 2008), as amended, as *“any substance or object which the holder discards or intends or is required to discard”*, construction demolition waste (CDW) *“arises from activities such as the construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning and maintenance”* and waste management is *“the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker”* (EC, 2019). In the context of this Proposed Licence Amendment, no construction waste or demolition waste is anticipated as no construction or demolition is required to facilitate a change in ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1. The chapter focuses on solid waste which arises during operation. The hydrology and hydrogeology chapter (Chapter 8), air quality chapter (Chapter 9), biodiversity (Chapter 6) and climate chapter (Chapter 10) will consider Proposed Licence Amendment at monitoring points relevant to those chapters.

The factory site is licenced to accept waste gypsum and a capped / decommissioned landfill is also located at the factory site. These will be discussed within the baseline section of this chapter.

The Proposed Licence Amendment does not seek to alter any parts of IEL P0519-03 pertaining to solid waste but looks to increase the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 (near the mine site). The mine water discharge from the mine site comprises natural groundwater which has come in contact with gypsum mineral underground. The water released to the stream is not subject to industrial use; the water is being collected from the underground workings or the quarry pit and discharged. As no change will occur to waste practices and as the Proposed Licence Amendment will not generate any construction or demolition waste, it has been determined a detailed waste assessment is not required.

15.2 Methodology

An environmental baseline was established using information freely available online including on the EPA licensing web portal and any additional information provided by the Applicant. The baseline included information contained in the Eastern-Midlands Region Waste Management Plan (EMRWMP) 2015-2021 (EMRWMP 2015) and the Connacht - Ulster Region Waste Management Plan (CURWMP) 2015 – 2021 (CURWMP 2015). The baseline also included information on the existing IEL P0519-03. The information provided in P0519-03 and the information provided by the Applicant to the EPA within their AER was used to identify if any exceedances have been recorded in the years 2018 and 2019 based on the information available.

15.2.1 Sources of Information

In preparing this report reference has been made to the following documents:

- Saint-Gobain Construction Products (Ireland) – P0519-03. Landfill Closure, Restoration and Aftercare Management Plan (CRAMP) – 2018 Update. (RPS 2018)
- Annual Environmental Report 2018 (SGCPI 2018)
- Annual Environmental Report 2019 (SGCPI 2019)
- EPA national waste statistics on municipal waste, hazardous waste, and construction and demolition waste
- BioCore Environmental response to the EPA in relation to IPPC licence review application Reg No. P0519-02 (BioCore Environmental 2012a & b)

- Gyproc environmental procedures on gypsum recycling and the disposal / recovery of non –hazardous waste (Gyproc 2018a)
- Gyproc environmental procedure on gypsum recycling (Gyproc 2015), and
- Gyproc procedure on waste management, document reference IMS16 (Gyproc 2018b).

15.2.2 Legislation and Guidance

The following relevant policy and legislation have informed this chapter:

Table 15-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
Waste Framework Directive 2008/851 (2018) (EU 2018)	Municipal waste constitutes approximately between 7 and 10 % of the total waste generated in the Union. Directive (EU) 2018/851 amends Directive 2008/98/EC including: • increase targets for preparing for re-use and recycling of waste; • remove substances intended for animal feed from the scope of Directive 2008/98/EC; • add a number of new definitions; • change end-of-waste conditions and requirements; • set out exemptions for separation of waste collection; • establish bio-waste separation; • establish household hazardous waste collection; • and update record keeping requirements. This Directive adds the following three new targets: • By 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55% by weight; • By 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60% by weight; and • By 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65% by weight.
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU (2015) (EU 2014)	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed; this includes waste
Eastern Region Waste Management Plans (2015-2021) (EMRWMP 2015) and Connacht - Ulster Region Waste Management Plan (2015 – 2021) (CURWMP 2018)	For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands and Connacht-Ulster. Waste management plans for the three regions were published in May 2015. The mine site of the Proposed Licence Amendment Is located in the Eastern-Midlands Waste Region while the factory site of the Proposed Licence Amendment Is located in the Connacht-Ulster Waste Region. The WMP for these waste regions is the framework for the prevention and management of wastes in a safe and sustainable manner.
Basel Convention (1992)	The Basel Convention regulates transboundary movements of hazardous wastes and provides obligations upon its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. The main principles of the convention are as follows: • Transboundary movements of hazardous wastes should be reduced to a minimum, which is consistent with their environmentally sound management • Hazardous wastes should be treated and disposed of as close as possible to their source of origin • Hazardous waste generation should be reduced and minimised at source • Annexes I–VIII of the Basel Convention provide lists of waste categories requiring special consideration or controls, including disposal operations. • Annex I outlines a list of waste categories to be controlled, Annex II details waste categories requiring special consideration and Annex III provides a list of important hazardous characteristics.
A Resource Opportunity – Waste Management Policy in Ireland (2012)	Waste policy and legislation are implemented largely by the EPA and the local authorities. The current waste management policy is set out in A Resource Opportunity – Waste Management Policy in Ireland, which was published in 2012. Among other things, this policy document sets out the policy on eliminating landfill, reducing the amount of waste produced and maximising waste as a source of products and renewable energy. The EPA's main activities in the waste management area are: • Drawing up and reviewing the National Hazardous Waste Management Plan;

Legislative Policy and Guidance Description of why the Legislative Policy and Guidance is of Relevance

	• The integrated pollution prevention and control (IPPC) licensing system, which deals with the generation, recovery and disposal of waste; • Development of guidelines for the selection, management, operation and ending of use of landfill sites; • Authorisation of waste imports; and • Maintenance of a national waste database. The local authorities are responsible for: • Authorisation and control of commercial waste collection activities; • Authorisation of waste exports and monitoring of internal movements of hazardous wastes; • Waste permits for small-scale recovery and disposal activities; • Ensuring adequate waste collection, recovery and disposal arrangements in their areas; and • Monitoring and inspection of waste activities generally.
European Communities (Waste Directive) Regulations, 2011, S.I. No 126 of 2011 (2011)	This regulation transposes the EU Waste Framework Directive into Irish legislation, and (amongst other provisions) allows an operator to decide that a material is a by-product and not a waste material if approved by the EPA.
Waste Management Act 1996 and Amendment Act 2001 (2001)	The Waste Management Acts provide for a general duty on everyone not to hold, transport, recover or dispose of waste in a manner that causes or is likely to cause environmental pollution.
Protection of the Environment Act 2003	The Integrated Pollution Prevention and Control Directive was transposed into Irish law in 2003 with the enactment of the Protection of the Environment Act, 2003. While the 1992 Act anticipated and implemented most of the requirements of the Directive, the PoE Act 2003 made legislative provision for the remaining elements. Though some of these were technical or procedural in nature, they all contribute to a significantly strengthened regulatory framework for environmental protection.
European Union (Industrial Emissions) Regulations 2013	These Regulations primarily amend the EPA Act 1992 as amended and the Waste Management Act 1996 as amended, to transpose Chapters II and VI of Directive 2010/75/EC of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast). The Regulations apply to the industrial emissions directive activities specified in the First Schedule to the Environmental Protection Agency Act 1992 as amended by these Regulations

15.2.3 Study Area

The study area was deemed to include the footprint of both the mine site and the factory site however no change or impact to existing waste practices are anticipated from the Proposed Licence Amendment and the Proposed Licence Amendment will not generate any construction or demolition waste.

15.2.4 Determining Sensitive Receptors

Assessment of waste impacts does not follow the typical EIA methodology and approach of identifying receptors and determining their sensitivity that is typically used for other environmental aspects given:

- Waste producers have a legal duty of care to manage their waste in accordance with regulations and to ensure that any waste leaving the site of generation is transferred to a suitably licensed facility for further treatment or disposal
- Facilities transferring, treating or disposing of waste must be either licensed or apply for an exemption from a license. Impacts arising from the operation of waste management facilities are considered as part of the planning and permitting process for such facilities, and
- Waste collectors are required by the Waste Management (Waste Collection Permit) Regulations 2007 as amended, to have, and comply with conditions of, a permit to collect waste. Offaly County Council was appointed the National Waste Collection Permit Office in 2012 and is responsible for administering waste collection permits in the Republic of Ireland.

15.2.5 Significance / Evaluation Criteria

As the Proposed License Amendment does not alter waste practices and as the Proposed Licence Amendment will not generate any construction or demolition waste, it has been determined a detailed environmental assessment was not required and as such a methodology outlining significance and evaluation criteria has not been included with this chapter.

15.2.6 Limitations in the Methodology and Gaps in Information

Waste information is provided by the Applicant to the EPA annually through the submission of an AER report however some of the information contained within the 2018 AER was not available within the 2019 AER. The information contained within this chapter was based upon information produced by others and available on line. For the purpose of this study, it has been assumed that the information obtained from available sources are reliable and reflective of the study area. This information has not been checked or verified by AECOM. The scope of this chapter did not include a waste audit of the factory and mine sites. It was assumed all waste taken off site is done so using a licenced haulier and that waste is removed by the licenced haulier to a licenced waste facility and that records of this are stored at the mine and factory site.

15.3 Description of the Existing Environment & Baseline Information

15.3.1 Waste Regions

15.3.1.1 Eastern Midlands Waste Region

The factory site is located within the Eastern-Midlands Waste Region. Dublin City Council is the appointed regional lead (Eastern-Midlands Waste Regional Office) and is responsible for the implantation of the Eastern-Midlands Region Waste Management Plan (EMRWMP) 2015-2021 (EMRWMP 2015). The plan provides a framework for the prevention and management of waste in a sustainable manner in 12 local authority areas. The three key objectives of the EMRWMP are:

- Prevent waste: a reduction of one per cent per annum in the amount of household waste generated per capita over the period of the plan
- More recycling: achieve a recycle rate of 50% by 2020 for managed municipal waste, and
- Further reduce landfill: eliminate all unprocessed residual municipal waste going to landfill from 2016 in favour of higher value pre-treatment processes and indigenous recovery practices.

The definition of municipal solid waste in Ireland is broad and includes household waste and waste from the commercial sector including non-process industrial waste. The EMRWMP 2015-2021 identified the quantity of municipal solid waste within the region as 1,298,239 tonnes in 2012, commercial waste collected within the region equated to 568,873 tonnes in 2012 and construction and demolition waste arisings for the region were estimated to be 1.91 million tonnes in 2012. Landfill Leachate was noted to have increased between 2010 and 2012 with 236,396 tonnes generated in 2012 (EMRWMP 2015).

15.3.1.2 Connacht-Ulster Waste Region

The mine site is located within the Connacht-Ulster Waste Region. Mayo County Council is the appointed regional lead (Connacht-Ulster Waste Regional Office) and is responsible for the implantation of the Connacht - Ulster Region Waste Management Plan (CURWMP) 2015 – 2021 (CURWMP 2015). The plan provides a framework for the prevention and management of waste in a sustainable manner in nine local authority areas. The three key objectives of the CURWMP are the same as those outlined in the EMRWMP (detailed in Section 15.3.1.1).

The CURWMP Plan 2015-2021 identified commercial waste collected within the region equated to 156,161 tonnes in 2012 and construction and demolition waste arisings for the region were estimated to be 319,095 tonnes in 2012. Mining and quarry waste was documented as 84 tonnes in 2012 a reduction from 137 in 2011 and 1,053 in 2010 (CURWMP 2015).

15.3.1.3 All Ireland

Figures released by the EPA (2019a) based on data from 2017 show that 2,768,043 tonnes of municipal waste was produced in Ireland in 2017, and of this 40% was recycled. The breakdown showed 1,520,290 tonnes originated from waste generated by households while 1,247,753 tonnes was generated from other sources. Figures released by the EPA (2020) on hazardous waste shows a total of 526,397 tonnes of hazardous waste were generated in Ireland in 2018 and 383,903 tonnes (73%) was exported for treatment abroad. Ireland does not have the facilities required to treat the full range of hazardous wastes it produces. The EPA (2019b) identified an estimated 4,749,700 tonnes of C&D waste were collected by authorised waste collectors, soil and stones was found to make up 81% of the total quantity, mixed C&D waste were identified to account for 8% of the total, while concrete, bricks, tiles and similar accounted for 7%.

15.3.2 Waste Aspects of IEL P0519-03

The existing IEL P0519-03 includes the following waste activities:

- Class 1 1.1 The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated, with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required, and
- Class 11.5 Landfills, within the meaning of section 5 (amended by Regulation 11(1) of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)) of the Act of 1996, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25,000 tonnes, other than landfills of inert waste.

The existing licence authorises the importation of up to 18,000 tonnes per annum of non-hazardous gypsum based construction material (European Waste Catalogue (EWC) Code 17 08 02) for recycling at the installation as outlined under Schedule A, section A.2 of IEL P0519-03.

Under Condition 8 of IEL P0519-03 an extractive waste management plan for the minimisation, treatment, recovery and disposal of extractive waste must be in-place on site and reviewed at least once every five years. The plan must meet the requirements of Regulation 5 of the Waste Management (Management of Waste from the Extractive Industries) Regulations, 2009. A report on the implementation of the Extractive Waste Management Plan shall be provided in the Annual Environmental Report (AER) supplied to the EPA. A number of additional conditions relating to waste and landfill are covered within Condition 8 of IEL P0519-03 (see Volume 3, Appendix A.15.1) including:

- A condition that the recovery of waste on site should only take place in accordance with the conditions of the licence and National and European legislation
- Only extractive waste shall be placed in excavation voids. When placing extractive waste into excavation voids for rehabilitation and construction purposes, the licensee shall, in accordance with Regulations 10 and 13(5) of the Waste Management (Management of Waste from the Extractive Industries) Regulations, 2009, and the Extractive Waste Management Plan, secure the stability of the waste, put in place measures to prevent pollution of soil, surface water and ground water; and, carry out monitoring of the extractive waste and excavation void
- Existing waste facilities are to be managed and maintained to ensure physical stability and to prevent pollution or contamination of soil, air, surface water or groundwater, and a system for regular monitoring and inspection of the waste facilities should be established and maintained
- All records of monitoring and inspection of waste facilities, as required under the licence, shall be maintained on-site
- No waste classified as green list waste in accordance with the EU Shipment of Waste Regulations (Council Regulation EC No. 1013/2006, as may be amended) shall be consigned for recovery without the agreement of the Agency
- Unless agreed in writing, in advance, by the Agency the licensee is prohibited from mixing a hazardous waste of one category with a hazardous waste of another category or with any other non-hazardous waste
- The licensee shall neither import waste into the State nor export waste out of the State except in accordance with the relevant provisions of Regulation (EC) No 10 13/2006 of the European Parliament and of the Council of 14th June 2006 on shipments of waste and associated national regulations

- No waste shall be disposed of at the on-site landfill and activities and monitoring at the landfill shall be in accordance with the agreed CRAMP or as otherwise agreed by the Agency
- Waste shall only be accepted at the processing site (factory site) from local authority waste collection or transport vehicles or holders of valid waste collection permits, unless exempted or excluded, issued under the Waste Management (Collection Permit) Regulations 2007, or as may be amended, and
- No hazardous wastes shall be accepted at the processing site (factory site).

15.3.3 The Mine Site and The Factory Site

15.3.3.1 General Information

Gypsum waste is generated at the factory site as board plant dry waste, board plant wet waste, and plaster products dry waste. As outlined above the factory site also includes a gypsum recycling facility which accepts gypsum off cut waste from customers (Gyproc 2015). No raw waste is produced from quarrying and processing of gypsum at the mine site (BioCore Environmental 2012a). No soil or bedrock material is exported from the mine site as a waste material, all extracted material can be reused.

Non-hazardous waste is generated from processes on site, and from laboratories and offices at the mine and factory sites. The waste is stored in designated, labelled areas around the mine and factory site before it is taken away by licenced waste contractors (Gyproc 2018a). Recycling schemes are in place at the mine site and factory site for products such as ink cartridges, timber, cardboard and paper (Gyproc 2018a). Waste material generated at the mine site include normal office waste, scrap metal, waste oil, timber, tyres and plastics.

Where scrap metal is produced from maintenance workshops, or from redundant plant equipment, the scrap metal is placed in a designated skip at the mine and factory site and is removed for recycling by an approved contractor (Gyproc 2018a). Timber pallets are re-used on site where possible and broken or unusable pallets are placed in designated skips on site and sent for recycling. Cardboard and plastic generated on site are recycled (Gyproc 2018a). Waste oils and chemicals are also produced by the workshops on site. These are stored in a designated bunded area and removed from site by a licenced waste contractor, the bunds are integrity tested (BioCore Environmental 2012a).

Waste weights and disposal records are kept by the EHS Department. The EHS Department also produce an annual report on waste management detailing the quantities of all the different types of waste disposed of or recycled from the plant (Gyproc 2018a).

In addition to the waste generated on site, gypsum waste is accepted onto the factory site in line with the conditions set out in IEL P0519-03. This is then recycled onsite and used during the production process where possible. The gypsum recycling plant has facilitated a reduction the traditional raw material (gypsum rock) usage and enabled the closure of the onsite landfill. It also provides a recovery facility for gypsum which facilitates gypsum recovery as opposed to its disposal (BioCore Environmental 2012a). A septic tank is located at both the mine and factory sites. Sludge from the Wastewater Treatment Plant (WWTP) at the factory site and from the septic tanks at the mine site is collected by an approved contractor (Gyproc 2018a). A hydro international biological treatment system waste water treatment plant was installed at the factory site in 2006. The WWTP treats raw sewage at the factory site through the use of physical and biological treatment prior to discharge to a percolation area (RPS 2018; further information available in BioCore Environmental 2012b).

In relation to waste water treatment Condition 3 of IEL P0519-03 states: *"the licensee shall maintain a wastewater treatment system at the installation for the treatment of sanitary effluent arising on-site. Any wastewater treatment system and percolation area shall satisfy the criteria set out in the Code of Practice Wastewater Treatment and Disposal Systems Serving Single Houses (p. e 5 IO), published by the Environmental Protection Agency"*. A septic tank and percolation area is located to the east of the railway line at the factory site.

A capped / decommissioned landfill is located to the east of the factory plant and is accessed through the factory site (see Volume 3, Appendix A.15.2, Figure A.15-1). This landfill is reported to include wet waste, dry edging waste, dry waste and a small amount of general waste which arose from the facility (RPS 2018) and was used for the disposal of waste plaster and plaster board. In the past the landfill was also used for construction and demolition waste, wooden pallets, plastics, and domestic type waste (BioCore Environmental 2012a). Gypsum Industries have operated the landfill at the factory site since 1936 with official records of waste deposited beginning in 1970. The capping works on the landfill commenced in July 2017 and were completed by May 2018 (RPS 2018). The capping of the landfill has provided an integrated approach to pollution control. RPS (2018) identified the pollution controls as:

- *"The landfill capping system acts as a barrier layer and restricts moisture ingress and migration of landfill gas*
- *The instillation of passive gas venting allows the control venting of gas from underneath the cap*
- *The leachate management system controls the leachate from the waste body*
- *The surface water management system controls the surface water arising on the restored landfill and ensures it does not erode the landfill capping. This surface water is also managed so that it does not increase leachate generation within the landfill, and*
- *Fixed monitoring points provide an outlet for monitoring for potential environmental impacts which may be caused by landfill".*

The leachate from the capped / decommissioned landfill is treated via four surface water / leachate lagoons located to the north of the landfill. The leachate is collected in the western edge of the landfill and decants sequentially through lagoons 1, 2 and 3 during which time suspended material settle out. Leachate is pumped from pond 3 to pond 4 and recycled back to the production plant at the factory site where it is used as a water supply for the production plant (RPS 2018).

15.3.3.2 Annual Environmental Report – Waste Information

The wastes stream summary as provided by the Applicant to the EPA in the 2018 and 2019 AER suggests a total of 27.163 tonnes of hazardous waste was generated in 2018 compared to 23.57 tonnes in 2019. Of this 0 tonnes went to landfill in both 2018 and 2019, 0.58 tonnes was incinerated in 2018 compared to 0.581 tonnes in 2019, 25.504 tonnes was recycled in 2018 compared to 22.989 tonnes in 2019 and 1.078 tonnes was documented as other in 2018 (see Table 15-2 and Volume 3, Appendix A.15.1). These figures are totals for the mine and factory site combined as the waste summary provided within the AER did not provide a breakdown between the mine site and factory site.

In 2018 a total of 26,277 tonnes of non-hazardous waste was generated compared to 28,873 tonnes in 2019 [Of this 90.26 tonnes went to landfill in 2018 compared to 0 tonnes in 2019, 419.2 tonnes went for incineration in 2018 compared to 0 tonnes in 2019, 3,087.78 tonnes were recycled in 2018 compared to 28,782 tonnes in 2019 and 71.92 tonnes was documented as other in 2018 compared to 91.02 tonnes in 2019 (see Table 15-2 and Volume 3, Appendix A.15.1). These figures are totals for the mine and factory site combined as the waste summary provided within the AER did not provide a breakdown between the mine site and factory site.

The AER for 2018 and 2019 also contains summary details of waste accepted onto the site in accordance with limitations as set out under Schedule A, section A.2 of IEL P0519-03. The summary identified that 1,015 tonnes of waste plasterboard for recycling on site (waste type 17 08 02) was accepted in 2018, an increase of 35% on the previous year (2017). In comparison 991 tonnes was accepted in 2019 a decrease of 2% on the previous year. The summary identified that 51 tonnes of the waste material remained on site at the end of 2018 compared to 50 tonnes in 2019 (see Table 15-3 and Volume 3, Appendix A.15.1).

Table 15-2 Waste Stream Summary

	Total	Landfill	Incineration	Recycled	Other
2018					
Hazardous (Tonnes)	27.163	0	0.581	25.504	1.078
Non-Hazardous (Tonnes)	3,669.16	90.26	419.2	3,087.78	71.92
2019					
Hazardous (Tonnes)	23.57	0	0.581	22.989	
Non-Hazardous (Tonnes)	28,873	0	0	28,782	91.02

Source: <Annual Environmental Report 2018 & 2019>

Table 15-3 Details of Waste Accepted onto the Factory Site for Recovery, Disposal or Treatment

Licenced annual tonnage limit per annum	EWC Code	Quantity of waste accepted (tonnes)	% increase or reduction on previous year	Quantity of waste remaining on site at the end of the reporting year (tonnes)
2018				
18000	17 08 02	1015	Increase of 36%	51
2019				
18000	17 08 02	991	Decrease of 2%	50

Source: <Annual Environmental Report 2018 & 2019>

15.3.4 Waste Management Procedure

A waste management procedure is in place on site which is the responsibility of the Environmental, Health and Safety (EHS) manager. Waste is separated and segregated into hazardous and non-hazardous wastes and stored in appropriate areas to prevent environmental contamination, cross contamination and / or injury to health. The waste management procedure considers the hierarchy of avoid, reduce, re-use / recycle, incineration with energy recovery, landfill.

Where waste is taken off site the waste management procedure requires “appropriate evidence that the carrier is legally entitled to provide the service. This shall be either sight of the certificate of registration, confirmation of an entry on the public register (see register of legislation) or proof of exemption. Record of evidence obtained will be maintained. The carrier's registration should be checked yearly by reviewing the EPA or County council list of approved carriers to ensure that registration is kept up to date. Copies of transfer notes are retained for seven years” (Gyproc 2018b).

15.3.5 Sensitive Receptors

The scope of this waste chapter does not assess the potential environmental impacts on sensitive receptors in the surrounding environment that may be caused by the handling, temporary storage and transportation of waste during the operation of the mine and factory sites. The Proposed License Amendment does not alter waste practices and the Proposed Licence Amendment will not generate any construction or demolition waste. Waste generated on site is conditioned by IEL P0519-03. Emission and compliance limits for the mine and factory sites are also licenced by IEL P0519-03.

15.4 Description of Potential Impacts / Comments on Monitoring Results

The Proposed Licence Amendment is related to a request to increase the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 µS/cm to 2,360 µS/cm at Compliance Point CP-1. No additional infrastructure is required to facilitate an increase in ELV for sulphate and electrical conductivity, no demolition is required, no additional waste will be generated (ELV at water monitoring point is considered in Chapter 8 Hydrology and Hydrogeology). The Proposed Licence Amendment does not look to alter any solid waste related limits or requirements set out within the existing IEL P0519-03. Solid waste quantities and procedures on site will not be impacted by the Proposed Licence Amendment

15.4.1 The Mine Site and The Factory Site

All waste procedures on site are to be compliant with IEL P0519-03 and licence returns should be in accordance with IEL P0519-03. Based on the information contained within the 2018 and 2019 AER it appears the waste limits set out by IEL P0519-03 relating to the acceptance of gypsum material on site have been adhered to at the factory site. The existing licence authorises the importation of up to 18,000 tonnes per annum of non-hazardous gypsum based construction material (EWC Code 17 08 02) for recycling at the factory site as outlined under Schedule A, section A.2 of IEL P0519-03. The AER documents 1,015 tonnes accepted onto the factory site in 2018 and 991 tonnes in 2019. Of this 51 tonnes remained at the factory site in 2018 and 50 tonnes remained at the factory site in 2019.

It is assumed all other wastes leaving the factory and mine sites are stored and transferred in line with the conditions of IEL P0519-03. It is assumed all waste taken off site is done so using a licenced haulier and that waste is removed by the licenced haulier to a licenced waste facility and that records of this are stored at the mine and factory site. However solid waste quantities and waste procedures on site will not be altered by the Proposed Licence Amendment.

15.5 Mitigation Measures

This Proposed Licence Amendment does not look to alter any of the solid waste limits or monitoring requirements relating to solid waste within the existing IEL P0519-03. The Proposed Licence Amendment relates only to an amendment to the ELV for sulphate and electrical conductivity at Compliance Point CP-1. No mitigation measures were identified. Monitoring and reporting of waste to the EPA will continue as outlined within IEL P0519-03.

15.6 Cumulative Impacts

The Proposed Licence Amendment will not result in an increase in waste production at the mine or factory site. As no additional waste will be produced the Proposed Licence Amendment will not require the transfer of additional waste off site to waste receiving / treatment facilities and as such will not increase the tonnage of waste sent from the mine site or factory site to waste receiving / treatment facilities. The Proposed Licence Amendment is therefore not expected to add to cumulative demand for capacity at waste receiving / treatment facilities from other waste-generating projects within the wider environs.

15.7 Residual Impacts

This Proposed Licence Amendment does not look to alter any of the waste limits or monitoring requirements relating to waste within the existing IEL P0519-03. The 2018 and 2019 AER suggest waste practices at the factory site are in line with the limits set by IEL P0519-03 for gypsum recycling on site. No additional mitigation measures or residual impacts were identified.

15.8 Summary

The 2018 and 2019 AER indicate that waste practices at the factory site are in line with the limits set by IEL P0519-03 for gypsum recycling on site. No additional waste will be produced, and the Proposed Licence Amendment will not require the transfer of additional waste off site to waste receiving / treatment facilities and as such will not increase the tonnage of waste sent from the mine site or factory site to waste receiving / treatment facilities.

The Proposed Licence Amendment does not seek to alter waste limits or monitoring requirements relating to solid waste within the existing IEL P0519-03. The Proposed Licence Amendment relates only to an amendment to the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1. No additional infrastructure is required to facilitate an increase in sulphate and electrical conductivity and the increase in sulphate and electrical conductivity is not anticipated to alter the waste environment at the mine or factory sites.

16 Major Accidents and Disasters

16.1 Introduction

This chapter describes the potential for future Major Accidents and Disasters (MA&D) relating to the Proposed Licence Amendment to the existing IEL for the Drummond Mine in County Monaghan, operated by Saint-Gobain Construction Products (Ireland) Limited. A description of the installations associated with this IEL is contained in Chapter 3 Project Description, which comprise of a mine site located in County Monaghan and a factory site located in County Meath, approximately 7 km apart (Figure 16-1).

An increase in the ELV for sulphate and electrical conductivity at Compliance Point CP-1 at the mine site is being sought following the unexpected ingress of water to the Drummond underground mine and subsidence occurring in the redundant Drumgoosat underground mine which has resulted in an increase in monitored sulphate concentration. Conductivity is closely connected to sulphate concentration, such that lowering sulphate concentration causes lower Conductivity, and raising sulphate concentration increases Conductivity. Thus regulation of sulphate concentration automatically regulates the associated Conductivity. In light of this the IEL review seeks to increase the current ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$.

The subsequent direct discharge of mine water from the mine site to the River Bursk during lower flows in the river (during the summer period, between April and September) has resulted in a continued risk of potential breach of the IEL compliance for sulphate (200 mg/L) and electrical conductivity (1000 $\mu\text{S}/\text{cm}$) in the River Bursk at Compliance Point CP-1. The existing Compliance Point CP-1 to which the Proposed Licence Amendment relates is located circa 70 m downstream of the mine site discharge point to the River Bursk (Figure 16-1). A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of Compliance Point CP-1. Further information is available in Chapter 1 Introduction and Chapter 3 Project Description of this report.

This MA&D assessment takes into consideration the impact of an increase in the sulphate ELV of 200 mg/L to 1,250 mg/L (and the associated increase in electrical conductivity) at Compliance Point CP-1 adjacent to the mine site, which is established in the IEL. This higher limit is approximately 25% above the maximum sulphate concentration detected at Compliance Point CP-1.

A change in ELV for sulphate and electrical conductivity at Compliance Point CP-1 will not require the construction of any additional infrastructure as it will use the infrastructure already in place at the mine site. Consequently this study will not consider potential MA&D associated with construction operations. The increased limit of 1,250 mg/L facilitates exceptional and emergency flows. The existing discharge point at the mine site has been in use by the Applicant for circa 30 years.

The potential risk to surface and groundwater drinking water abstractions can be assessed based on drinking water standards. The drinking water standard for sulphate is 250 mg/L and the limit for groundwater sulphate levels of 200 mg/L given in EPA (2003). The World Health Organisation (WHO 2004) has established a guideline value for sulphate concentrations in drinking water of 250 mg/L, this concentration has also been adopted in Irish regulations as the parametric value for drinking water with European Union (Drinking Water) Regulations 2014 (S.I. 122/2014). Further information on the location of aquifers, wells and drinking water abstraction points is detailed within Chapter 8 Hydrology and Hydrogeology. Chapter 8 Hydrology and Hydrogeology considers it unlikely that any impact on local groundwater abstractions would be affected by the increased sulphate discharge and that water monitoring data and estimated sulphate concentrations indicated the drinking water abstraction (Tallanstown pumping station) located circa 18 km downstream of Compliance Point CP-1 is unlikely to be affected by the increased sulphate discharge. Further information on potential impacts to biodiversity are detailed in Chapter 6 Biodiversity.

The source of sulphates in emissions to water from the mine site are from groundwater and surface water in the area of the mine site which comes into contact with naturally occurring gypsum. Water that has come in contact with gypsum is characterised by elevated levels of sulphate. AECOM understands the source of sulphates in emissions to water from the factory site are from process including the use of gypsum and from gypsum storage areas.

At the mine site water that has come in contact with gypsum is directed to settlement lagoons prior to discharge to the River Bursk. From here the water flows to Rahans Lough prior to joining the River Glyde. At the factory site

surface water including that which may have come in contact with gypsum is diverted to settlement lagoons, from the lagoons the water enters a drainage ditch (EPA name: Ballynaclose, IE_NB_06G020070) where it flows north and joins the River Glyde. Further information is available in Chapter 3 Project Description and Chapter 8 Hydrology and Hydrogeology. As mentioned above a drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the Compliance Point CP-1. The main MA&D for consideration are those that could occur as a result of or in combination with sulphate that could lead to an impact on drinking water, to agricultural lands, aquifers or biodiversity.

The focus of this MA&D assessment is on the impact of the increase in sulphate concentration and the associated increase in electrical conductivity at the discharge point adjacent the mine site; however this chapter also contains a brief overview of the existing MA&D which have been identified for the mine site for completeness. Existing MA&D which have been identified for the factory site have not been included within this chapter as the factory site is situated circa 7 km apart from the mine site. The methodology used to identify and assess major accidents and disasters is described in Section 16.2, the output of the assessment is presented in Section 16.4 and a summary of conclusions is contained in Section 16.9.

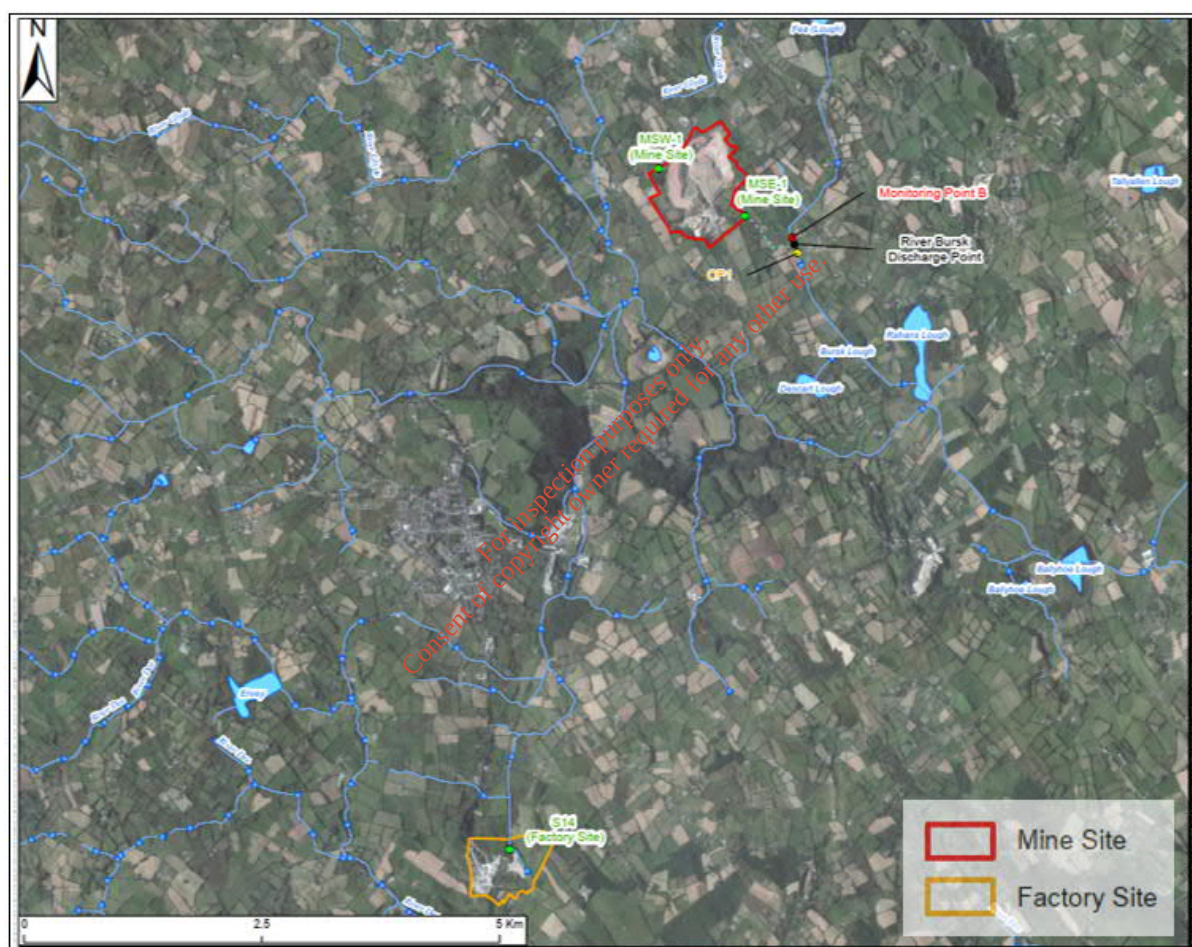


Figure 16-1 Location of the Mine Site and the Factory Site (Volume 3, Appendix 3.1, Figure A3-1)

16.2 Methodology

An assessment of MA&D is a requirement of all Environmental Impact Assessment Reports (EIAR), the purpose of which is to identify the most serious incidents which could potentially affect the site and the surrounding environment. The infrastructure, systems and procedures which have been installed to prevent these incidents and mitigate their consequences, are considered in this assessment.

The draft guidelines on the information to be contained within EIAR published by the EPA in 2017 (EPA 2017) form the basis of this assessment. The guidelines include a requirement to consider the risk of MA&D which are relevant to the project concerned, including those caused by climate change. For example, the potential for rising water levels causing flooding to the site from surround river networks. The assessment of MA&D is required to focus on impacts that are both likely and significant, with impact descriptions which are accurate and credible. These

descriptions should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects to the development.

This assessment was a desktop review carried out to consider the impact of increased sulphate emissions and the associated increase in electrical conductivity to water on the existing potential MA&D, employing a structured process to determine the credible and reasonably foreseeable impacts. This assessment reviews existing risk assessments carried out in 2018 and 2019 by KD Environmental Ltd. as part of an environmental liabilities risk assessment at the mine and factory sites. Relevant MA&D from these reports are considered in Table 16-3, Table 16-2 and Table 16-4. Additional risks considered during this review have also been included within these tables, which have been identified via personnel with significant risk assessment knowledge and experience (see Chapter 1 Section 1.9 of this report).

As the existing facilities are currently operational, safety management systems, including emergency procedures are in place at both the mine and factory sites. The emergency response procedure dated March 2019 has been considered during the review process and referenced in Table 16-3, Table 16-2 and Table 16-4, where they apply to each identified major accident hazard.

For each identified MA&D scenario, the qualitative assessment documented in Table 16-3, Table 16-2 and Table 16-4 considers the potential impact on the surrounding environment, taking into consideration the proximity and sensitivity of the receptors. The infrastructure, systems and procedures in place to prevent or mitigate the consequences of each scenario are also listed. A proportionate approach has been used in this assessment, based on the relative likelihood of each of the identified scenarios.

The main considerations relating to the Proposed Licence Amendment are connected to the presence of sulphate in water receptors such as surface and groundwater and the potential for this to reach abstraction points for drinking water or agricultural water use, this is considered further in Chapter 8 Hydrology and Hydrogeology. In the case of this Proposed Licence Amendment, all facilities and infrastructure required to facilitate the Proposed Licence Amendment are already constructed, both the mine and factory sites have been in operation for many years. The sulphate release at designated discharge points will only occur while the mine and factory sites are in operation, consequently this section of the EIAR does not specifically consider MA&D associated with construction and demolition phases of the facility lifecycle.

16.2.1 Definitions

Major accidents are defined as those that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident. The impact of major accidents can be very significant, with the potential to impact people both on and off-site, assets and property on and off-site, and the surrounding environment.

Disasters can be a naturally occurring phenomenon such as an extreme weather event (e.g. storm, flood, extreme temperatures) or ground-related hazard events (e.g. subsidence, landslide, earthquake) or can be caused by humans, such as fires and explosions with the potential to cause an event or situation that leads to immediate or delayed serious damage to human health, welfare and / or the environment.

Both natural and human causes are considered in this assessment to determine the impact on:

- (a) Population and human health, including persons employed at the facilities and in the local community. A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the Compliance Point CP-1. WHO (2004) concluded existing data did not identify a level of sulphate in drinking water that was likely to cause adverse human health effects and no health-based guideline value for sulphate in drinking water was proposed. However a noticeable taste in drinking water was identified at concentrations of 250 mg/L. A population and Human Health assessment is included in Chapter 5 of this report.
- (b) Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC. There are no European sites within 15 km of the mine or factory site and there are no nationally designated sites within 2 km of the mine or factory site. However, there are three statutory European sites and three statutory nationally designated sites that are hydrologically connected to and downstream of the effluent from both the mine site and factory site. Further information on these are provided in Chapter 6 Biodiversity. An NIS produced for the Proposed Licence Amendment (AECOM 2020) has concluded that there will be no significant effect on QI habitats or SCI species, that conservation objectives will not be compromised, and therefore that there will be No Adverse Effect on

the integrity of Dundalk Bay SPA, Dundalk Bay SAC or Stabannan-Braganstown SPA from the Proposed Licence Amendment either alone or in-combination with other projects or plans, therefore potential MA&D relating to sulphate are not considered for European designated sites.

- (c) Land, soil, water and groundwater, air and climate. Two potential surface water abstractions points from nearby water systems were identified, Tallanstown pumping station, location approximately 18 km downgradient of the mine site and Ervey Lough water supply located approximately 5 km up / cross gradient from the mine site. A direct impact on the Ervey Lough is not anticipated as it is located across gradient to the Glyde_30 river receiving the discharge water. Agricultural domestic wells have also been identified in the area surrounding the mine and factory sites. Chapter 8 Hydrology and Hydrogeology has identified impacts on surface water from the Proposed Licence Amendment *"would be limited to section immediately downstream of the point of discharge (ca. 2km) and do not affect water quality at know abstraction points in relation to the sulphate PV (250 mg/L)."*
- (d) Material assets, cultural heritage and the landscape. A rath has been identified within the boundaries of the mine site, rath (MO034-001). This is an archaeological feature characterised by a walled ringfort which are constructed from earth and stone. This asset has been enclosed by a hard fence to demarcate a 30 m buffer zone between it and any mine activities (Golder Associates 2017). The Proposed Licence Amendment to emissions to water will not directly or indirectly impact this site therefore potential MA&D are not considered for the rath.

Important considerations are the potential of the Proposed Licence Amendment to cause MA&D during operation, and the vulnerability of the Proposed Licence Amendment to potential man-made and natural disasters. The assessment of MA&Ds considers all disciplines outlined within the revised EIA Directive 2014/52/EU (population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape).

16.2.2 Sources of Information

- Integrated Management System – Emergency Response Procedure. Document Number IMSP5. Gyproc (2019)
- Environmental Liabilities Risk Assessment. KD Environmental Ltd. Report Number 2018/93/01. KD Environmental Ltd (2018)
- Environmental Liabilities Risk Assessment. KD Environmental Ltd. Report Number 2018/96/02. KD Environmental Ltd (2019)
- Drumgoosat Subsidence Event - Technical Report. Prepared for Saint-Gobain Mining (Ireland) Ltd. SRK Consulting (2018), and
- Department of Communications, Climate Action and Environment. Investigation of the Collapse of Workings at Drumgoosat. An Independent Review of the Works Completed by SRK. Wardell Armstrong (2018).

16.2.3 Legislation and Guidance

The following relevant policy and legislation has informed the scope for the impact assessment:

Table 16-1 Legislation, Policy and Guidance

Legislative Policy and Guidance	Description of why the Legislative Policy and Guidance is of Relevance
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed in an EIAR, this includes noise and vibration
S.I. No. 296 of 2018, European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	Directive 2014/52/EU is transposed into Irish Law under S.I. No 296. The Regulations describes the EIA process and lists noise and vibration as a factor to be contained in an EIAR.
European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018	Schedule 6, part (h) of the Regulations (Information to be Contained in EIAR) states: <i>"a description of the expected significant adverse effects on the environment of the proposed development deriving from its vulnerability to risks of major accidents and/or disasters which are relevant to it. Relevant information available and obtained through risk assessments pursuant to European Union legislation such as the Seveso III Directive or the Nuclear Safety Directive or relevant assessments carried out pursuant to national legislation may be used for this purpose, provided that the requirements of the Environmental Impact Assessment Directive are met."</i>

Legislative Policy and Guidance Description of why the Legislative Policy and Guidance is of Relevance

Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017)	<i>Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for, and proposed response to, emergencies arising from such events".</i> The Draft Guidance outlines environmental factors to be included in and EIAR which includes noise and vibration. The guidance also outlines the process to follow when carrying out an impact assessment as part of an EIAR.
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16.2.4 Study Area

The study area takes into consideration the mine site and the factory site.

16.2.5 Limitations in the Methodology and Gaps in Information

The principal difficulty for this assessment was the prediction of future sulphate levels and the inherent difficulty in assessing possible future sulphate levels which may exceed those observed following the unexpected ingress of water to the Drummond underground mine and the subsidence of the redundant Drumgoosat underground mine.

The information contained within this chapter was based upon information produced by others and available on the EPA licensing web portal. For the purpose of this study, it has been assumed that the information obtained from the available sources are reliable and reflective of the conditions of the study area. Any information provided by third parties and referred to herein has not been checked or verified by AECOM. A site study was not carried out to inform this chapter.

16.3 Description of the Existing Environment & Baseline Information

As mentioned above and in Chapter 1 Introduction, both the mine and factory sites have been in operation for many years and are licenced under IEL P0519-03 since 2015. Sulphate has been discharged from mine operations in the area to the River Bursk for the last 30 years. Sulphate is also discharged from the factory site. An increase in the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site is being sought following the unexpected ingress of water to the Drummond mine and the subsidence of Drumgoosat Mine. The concentration of 1,250 mg/L facilitates exceptional and emergency flows and is approximately 25% above the maximum sulphate concentration detected at Compliance Point CP-1. No construction is required to facilitate the Proposed Licence Amendment as no additional facilities or infrastructure are required.

Seven licensed facilities (P0866, P0806, P0065, P0528, P0037, P0371 and P0842) and one waste facility (W0195) are located within a 10 km radius of the mine site. The licenced sites located within a 10 km radius of the factory site were (P0612, P0640, P0037, P0528, P0065, P0866). These include treatments or processes for the purposes of the production of food products from animal raw materials, building products, the manufacture of coarse ceramics, the rendering of animal by-products and, the recovery or disposal of waste and the dyeing, treatment or finishing of textiles. These facilities do not appear to be Seveso facilities.

One EPA licensed facility (P0866-01) is within a 1 km radius of the mine site. The registered licensed activity, P0866-01 is for the rearing of poultry in installations where the capacity exceeds 40,000 places. The site does not have emissions to water or onsite disposal of materials as part of its licence.

The cumulative impact of these site from a water perspective has been considered in Chapter 8 Hydrology and Hydrogeology. Surface water monitoring point SW16 is downgradient of Breedon Brick (P0528) and so discharges from this facilities would be considered at this pointing point. Lissaden Towels (P0371) licence was surrendered in 2005.

16.3.1 The Mine Site

The mine site includes an operational opencast mine and underground mine. The opencast mine process and activities include the removal of topsoil, subsoil and overburden to expose gypsum rock using hydraulic excavators and dump trucks. The soil material is then stored on site for future reuse. Where gypsum is extracted primary

breaking occurs through blasting while secondary breaking is carried out using rock breakers. This material is then loaded by an hydraulic excavator onto a dump truck and transported to a surface crusher.

The material is then reduced to less than 300 mm using a primary and secondary crusher culminating in material less than 75 mm in size. This material is stored under cover until transported to the factory site or to a cement manufacturing facility. Once gypsum material has been fully removed from an area the area is backfilled using the stockpiled soil material (KD Environmental Ltd 2019).

The underground mine process and activities include the drilling and blasting of gypsum in a series of self-supporting tunnels. In areas of poor geology additional support is installed. The gypsum is loaded into dump trucks via rubber tyred loaders and transported to an underground primary crusher. From here the material is transported to the surface via a conveyor belt where it further crushed in the secondary crusher. No waste material is extracted removing the requirement for soil heaps or dumps (KD Environmental Ltd 2019).

A number of raw material and chemicals including hydrocarbons are stored on site, these are stored in bunded areas which undergo testing. An emergency response team and supplies of spill kits are also present on site. Further information on the raw material and chemicals stored at the mine site is included in KD Environmental Ltd (2019) Environmental Liabilities Risk Assessment. The materials stored on site would be similar to those stored on a regular industrial site.

16.3.2 The Factory Site

The main operation at the factory site is the processing of gypsum material into plasterboard and building plaster which involves the calcination of the gypsum material. The gypsum is mined at the mine site and transported to the factory site for further processing. At the factory site the gypsum material is crushed to produce a fine powder and heated to remove some of the water content of the gypsum material producing Plaster of Paris which is further crushed and calcinated at 140-170°C converting the gypsum to stucco, the raw material for building plaster and plasterboard.

Process chemicals are also added to prevent the product rehydrating to quickly (KD Environmental Ltd (2018). Plasterboard is produced by mixing the calcinated stucco with starch, water and air entraining agents to establish a material of fluid consistency with is spread onto large sheets of paper and covered by a second layer of paper forming plasterboard. This product is then dried using a 3 stage gas fired dryer KD Environmental Ltd (2018).

A number of raw material and chemicals including hydrocarbons and compressed gases are stored on site. These are stored in a range of places on site including bunded areas, storage cages, chemical storage areas, raw materials warehouse on site. An emergency response team and spill kits are also on site. Further information on the raw material and chemicals stored at the mine site is included in KD Environmental Ltd (2018) Environmental Liabilities Risk Assessment. The materials stored on site would be similar to those stored on a regular industrial site.

16.4 Assessment of Major Accidents and Disasters at the Mine and Factory Sites

The consideration of MA&D at the mine is detailed in Table 16-2, Table 16-3 and. Table 16-4. The information contained within these tables incorporates a number of reports outlined in Section 16.2.3. These reports have been carried out by others for the Applicant in line with the requirements of the mine and factory sites.

As mentioned previously the focus of this MA&D assessment is on the potential impact of the increase in sulphate concentration and the associated increase in electrical conductivity; however this chapter also contains a brief overview of the existing MA&D which have been identified for the mine site for completeness. Existing MA&D at the factory site have not been considered as the mine site is located circa 7 km from the factory site and there will be no change to the processes or operations at the factory site.

Existing MA&D identified by KD Environmental Ltd (2019) at the mine site, include oil and chemical storage failure, diesel storage failure, failure of interceptor, spill on site, unplanned explosion, general power failure. Existing MA&D identified by KD Environmental Ltd at the factory site are detailed within their liabilities risk assessment (KD Environmental Ltd 2018).

A summary of the conclusions of this assessment is contained in Section 16.9.

Table 16-2 Summary of Potential Major Accidents Relating to Sulphate

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning
Sulphate Release into the Environment Under a Worst Case Scenario	Potential for increased sulphate levels to occur within streams such as the River Bursk and the River Lagan at discharge and compliance points with the potential to impact the biodiversity of the streams. Potential to impact upon a water abstraction point on the River Glyde at Tallanstown. This is an abstraction point for drinking water.	The highest concentration of sulphate recorded at Compliance Point CP-1 following ingress of water at Drummond Mine and the release of stored water from Drumgoosat Mine was 998 mg/L on the 28/10/18. However sulphate levels are higher at the point of discharge. The Proposed Licence Amendment as set out within this document looks to increase the ELV for sulphate from 200 mg/L to 1,250 mg/L at Compliance Point CP-1 at the mine site. Should this amendment be facilitated the worst case scenario to date at CP-1 would not be above the licenced amount of sulphate allowed to be discharged. Onsite emergency response procedures in place would alert site operators to increased sulphate concentrations at CP-1 should water ingress from unidentified source occur at an underground mine	Reports have been commissioned by the Applicant to identify any potential impacts from the release of higher sulphate concentrations to the River Bursk and the River Lagan. These reports have been considered as part of the assessment within Chapter 6 Biodiversity and Chapter 8 Hydrology and Hydrogeology of this report. An assessment of the potential impacts of the Proposed Licence Amendment on hydrology and hydrogeology and biodiversity has been carried out within the respective chapters of this report. An assessment on potential impact to the population and human health was carried out in Chapter 5 of this report. The Proposed Licence Amendment may have potential impacts on the freshwater aquatic environment (see Chapter 6: Biodiversity). In relation to freshwater habitats the biodiversity chapter has concluded <i>"in view of the County level importance assigned to the overall habitats of the River Bursk, Bursk Lough and in particular Rahans Lough, there is considered to be a possible permanent adverse effect of County (medium in NRA terminology) significance on freshwater habitats", "there is considered to be a possible permanent adverse effect of Local significance on fish populations, with respect to coarse fish only", "there is expected to be a permanent adverse effect of Local significance on macroinvertebrates" and "a possible permanent adverse effect of Site significance only on otter".</i> The mitigation measures proposed by the biodiversity chapter are <i>"the implementation of water quality monitoring on a regular basis upstream of Ballyhoe Lough pNHA unless the mine water discharge ceases or is mitigated to much lower sulphate levels. In the event that the quality of water entering Ballyhoe Lough pNHA exceeds the recommended mean monthly sulphate level of 309 mg/L recommended in BC (2013) at the level of water hardness in the River Glyde, then liaison with EPA / NPWS will take place to consider further action"</i>. No impacts were identified on European designated sites. A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the Compliance Point CP-1. Studies carried out by Minerex Environmental (2019) have concluded that <i>"the increased discharge rate from the mine to the River Bursk has not led to the exceedance of any water regulation concentrations at Tallanstown"</i>. The average value for sulphate recorded by Minerex Environmental (2019) between 4/10/18 and the 1/2/19 at a sampling location upstream of Tallanstown (D1-SW16) was 96.38 mg/L. In addition a report by WHO (2004) concluded existing data did not identify a level of sulphate in drinking water that was likely to cause adverse human health effects and no health-based guideline value for sulphate in drinking water was proposed. However a noticeable taste in drinking water was identified at concentrations of 250 mg/L. In relation to drinking water abstraction points the Chapter 8 Hydrology and Hydrogeology concluded <i>"Impacts on surface water would be limited to section immediately downstream of the point of discharge (ca. 2km) and do not affect water quality at know abstraction points in relation to the sulphate PV (250 mg/L)."</i> The higher sulphate limit of 1,250 mg/L at Compliance Point CP-1 is approximately 25% above the maximum sulphate concentration detected at Compliance Point CP-1 and facilitates exceptional and emergency flows. Although a large release of sulphate could potentially result in localised impacts but is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident. No other potential for a MA&D have been identified.

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Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning
Significant Water Ingress from Unidentified Source	Should a significant unexpected water ingress occur within an underground mine, it could compromise the stability of the mine. Water ingress could also lead to an exceedance in ELV's at compliance points within streams at the mine site. Should water come in contact with fuels / oils within mobile machinery this could also lead to environmental contamination and could potentially injure people and damage assets. Potential to impact upon a drinking water abstraction point on the River Glyde at Tallanstown	The emergency response procedure for the site includes instructions to site personnel should water ingress to an underground mine occur. Working underground may lead to a situation where excess water is encountered through mining activities via unforeseen faults, fissures or cracks in the rock. Where ingress is identified, arrangements are made for the safe and environmentally friendly withdrawal of the area. Withdrawal includes removing any mobile plant and equipment to higher ground to prevent machinery containing fuels and oils etc. from contact with flowing water to prevent contamination of water with oils and fuels. The mine management team risk assess the area to determine suitability for implementing mobile dewatering units (e.g. tractors and pumps) and if the area is suitable, this equipment would be deployed ensuring appropriate spill kits and fire prevention equipment are available. The emergency response team would be on standby to respond to any safety or environmental emergencies that may arise including fire, spills etc. Water will be pumped to site lagoons using the water management infrastructure on site and calculations will be carried out to determine source and quantity of water ingress. . The EPA and Health and Safety Authority (HAS) and other local interest groups will be contacted as necessary. The procedure highlights that where possible, quantities of water above 510 m³ would not be pumped to the River Bursk as this will result in an exceedance to the Licence IEL P0519-03. An assessment of the chemical composition of the water is to be made before discharging from MSE-1 to confirm the appropriate flow rates to prevent ELV exceedances. If pumping to the River Bursk is necessary, the EPA will be informed and a water monitoring program above what is contained in the IEL P0519-03 will be implemented, including a toxicology report and a biological monitoring program. The emergency response procedure outlines sulphate levels must not exceed 200mg/L at Tallanstown and management of discharge from MSE 1 must be carefully managed. The plan also states that to prevent water ingress once under control, seek assistance from appropriate resources including mines inspector, EPA and specialist consultants as required on the following: how to prevent further water ingress; implement a plan to control the water ingress; develop a procedure as how to operate any physical barrier that may be constructed, and communications with appropriate stakeholders.	The emergency response procedure considers the potential for water ingress from unidentified source and has included measures to reduce potential impacts should this event occur as summarised in the prevention / mitigation section of this table. A review and update of the emergency response procedure was carried out following the ingress of water at Drummond Mine and the release of stored water from Drumgoosat Mine Minerex Environmental (2019). In this event, exceedances of sulphate above 200-250 mg/L were identified at various points along the River Bursk, however no exceedances were observed at a sampling point upstream of Tallanstown where water abstraction occurs. Studies carried out by Minerex Environmental (2019) have concluded that <i>"the increased discharge rate from the mine to the River Bursk has not led to the exceedance of any water regulation concentrations at Tallanstown"</i>. The average value for sulphate recorded by Minerex Environmental (2019) between 4/10/18 and the 1/2/19 at a sampling location upstream of Tallanstown (D1-SW16) was 96.38 mg/L The higher sulphate limit of 1,250 mg/L sought at Compliance Point CP-1 is approximately 25% above the maximum sulphate concentration detected at Compliance Point CP-1 and facilitates exceptional and emergency flows. Should an exceedance of an ELV occur the Applicant would investigate the cause of increase and would implement mitigation measures to prevent a reoccurrence. The EPA and other relevant stakeholders would be contacted. Any quality control system is to be in line with section 6.13.3 of IEL P0519-03. An assessment of the potential impacts of the Proposed Licence Amendment on population and human health, biodiversity, and hydrology and hydrogeology has been carried out in Chapter 5, Chapter 6, and Chapter 8 of this report respectively. It should be noted that an incident such as this could occur regardless of the Proposed Licence Amendment and a number of mitigation measure are currently in place on site should this occur. In terms of potential impacts upon drinking water abstraction points, studies by Minerex Environmental (2019) and Chapter 8 Hydrology and Hydrogeology of this report have identified no exceedances at the Tallanstown drinking water abstraction point. Although a large release of sulphate could result in localised impacts but is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident. .

Major Accident /
Disaster

Risks / Effects

Prevention / Mitigation

Reasoning

Failure to Meet Stormwater
ELV including ELV for
sulphate

Mine Site: Release of stormwater containing elevated contaminant levels such as sulphate, mineral oil, and suspended solids, amongst others at emissions point MSE1 (to the east of the mine site, eventually entering the River Bursk) and at emissions point MSW1 (to the west of the mine site) potentially resulting in the pollution of the River Bursk and the River Lagan (KD Environmental Ltd 2019).
Factory Site: Release of stormwater containing elevated contaminant levels at emissions point S14 (north of the lagoons at the factory site). Uncontrolled discharge from technical academy localised effect. Leading to the potential contamination of the Lagan River catchment and the technical academy lagoon discharge (KD Environmental Ltd 2018).

Mine Site: KD Environmental Ltd (2019) note continuous monitoring of Conductivity and sulphate occurs at MSE1. If parameters are high an automated shutdown of MSE1 would be initiated. It has been assumed this procedure will remain in place in line with IEL requirements. No automated shut down is in place for MSW1.
Factory Site: KD Environmental Ltd (2018) note continuous monitoring of the S14 Conductivity and sulphate levels occurs with automated shutdown of S14 if parameters are high. It has been assumed this procedure will remain in place in line with IEL requirements.

A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the Compliance Point CP-1. Studies carried out by Minerex Environmental (2019) have concluded that *"the increased discharge rate from the mine to the River Bursk has not led to the exceedance of any water regulation concentrations at Tallanstown"*. The average value for sulphate recorded by Minerex Environmental (2019) between 4/10/18 and the 1/2/19 at a sampling location upstream of Tallanstown (D1-SW16) was 96.38 mg/L. In relation to drinking water abstraction points Chapter 8 Hydrology and Hydrogeology concluded *"Impacts on surface water would be limited to section immediately downstream of the point of discharge (ca. 2km) and do not affect water quality at know abstraction points in relation to the sulphate PV (250 mg/L)."*
The Proposed Licence Amendment may have potential impacts on the freshwater aquatic environment (see Chapter 6: Biodiversity). In relation to freshwater habitats the biodiversity chapter has concluded *"in view of the County level importance assigned to the overall habitats of the River Bursk, Bursk Lough and in particular Rahans Lough, there is considered to be a possible permanent adverse effect of County (medium in NRA terminology) significance on freshwater habitats", "there is considered to be a possible permanent adverse effect of Local significance on fish populations, with respect to coarse fish only", "there is expected to be a permanent adverse effect of Local significance on macroinvertebrates" and "a possible permanent adverse effect of Site significance only on otter"*. The mitigation measures proposed by the biodiversity chapter are *"the implementation of water quality monitoring on a regular basis upstream of Ballyhoe Lough pNHA unless the mine water discharge ceases or is mitigated to much lower sulphate levels. In the event that the quality of water entering Ballyhoe Lough pNHA exceeds the recommended mean monthly sulphate level of 309 mg/L recommended in BC (2013) at the level of water hardness in the River Glyde, then liaison with EPA / NPWS will take place to consider further action"*. No impacts were identified on European designated sites.
Should an exceedance of an ELV occur the Applicant would investigate the cause of increase and would implement mitigation measures to prevent a reoccurrence. The EPA and other relevant stakeholders would be contacted. Any quality control system is to be in line with section 6.13.3 of IEL P0519-03.
An exceedance of ELV could occur regardless of the Proposed Licence Amendment however a number of mitigation measure are currently in place on site should this occur. An exceedance of an ELV including the Proposed ELV for sulphate could result in localised impacts but is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident.

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Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning
Overtopping of Lagoon Walls Causing Uncontrolled Release of Stormwater	Lagoons are present on both the mine and factory sites to provide containment of surface water and firewater runoff. Uncontrolled release of stormwater containing elevated sulphate levels, with risk of contaminating the River Bursk KD Environmental Ltd 2019). Factory Site: Uncontrolled release of stormwater from lagoons 1-4 containing elevated levels of sulphate. Stormwater run-off could potentially reach the discharge point into the stream (KD Environmental Ltd 2018).	KD Environmental Ltd (2019) note the lagoon system is located away from the River Bursk and an overtopping would be most likely to occur during a flood event where the dilution factor provided by the stream would be at its highest. Factory Site: KD Environmental Ltd (2018) note there hasn't been a history of flooding at the lagoons however a wall of a lagoon had subsided in the recent past. The wall has since been reconstructed and lined.	An increase in the sulphate ELV at Compliance Point CP-1 would not require a change in the flow levels entering the lagoons and should not increase the volume of water entering the lagoon. A drinking water abstraction point is located on the River Glyde at Tallanstown, circa 18 km downstream of the Compliance Point CP-1. Studies carried out by Minere Environmental (2019) have concluded that <i>"the increased discharge rate from the mine to the River Bursk has not led to the exceedance of any water regulation concentrations at Tallanstown"</i>. In the event of a flood it is considered unlikely that the lagoons would overtop as excess surface water run-off is likely to drain into the open pit mine. The open pit mine water requires pumping for water to enter the lagoons. Additionally the lagoons are located away from the River Bursk and water release is controlled by a pump and alarm system, therefore the likelihood of flood water reaching the lagoon and eventually the River Bursk is negligible. In light of the above, a significant impact is not anticipated at the Tallanstown abstraction point and the uncontrolled release of stormwater has not been considered further.
Fire on Site - Potential Release of Contaminated Firewater to the Environment	In the event of a major fire at the site, firewater may be applied by the Fire and Rescue service. A major fire could potentially destabilise the mine resulting in water ingress. Generation of firewater contaminated with sulphates and other pollutants which could result in harm to the environment such as soil and water contamination	The emergency response procedure states that an emergency response team is in place who would respond to fire alarms on site. Trained staff can use fire extinguishers to contain the fire if safe to do so. Where required the emergency response team will seal all nearby storm water drains using the bungs provided in the emergency response compound. If contaminated water enters the storm drains / river, the EHS Manager must contact the EPA, local authorities and the Fisheries Board. KD Environmental Ltd (2019) note that there is fire abatement equipment throughout the site, that at the mine site there is no history of fire on site, and a low volume of environmentally risky materials are stored on site.	The potential for a major fire at the site is low due to limited quantity of combustible and / or flammable materials on site such as diesel fuel oil. An increase in the sulphate ELV at Compliance Point CP-1 would not increase the required application rate of firewater in an emergency. The site emergency response procedure considers the potential occurrence of fires on site, the emergency response team on site will seal nearby storm drains in an emergency should it be required. There is potential for fire-water runoff to contain sulphate (ESR 2001). However, sulphate and gypsum are non-combustible and would be disposed of as storm water. In terms of impacts to drinking water, a report by WHO (2004) concluded existing data did not identify a level of sulphate in drinking water that was likely to cause adverse human health effects and no health-based guideline value for sulphate in drinking water was proposed. However, a noticeable taste in drinking water was identified at concentrations of 250 mg/L. However, a concentration of 250 mg/L has been adopted in Irish regulations as the parametric value for drinking water with European Union (Drinking Water) Regulations 2014 (S.I. 122/2014). Further assessment required consisting of an updated firewater containment assessment for the mine site to ensure it is in line with most recent legislation / guidance and a review of the storm water pollution prevention plan for the mine and factory site. Although further assessment is required the release of fire water to the environment which could contain sulphate is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident.

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning
Ground Collapse / Subsidence	Movement in the ground below the site, adjacent houses and infrastructure such as roads could damage infrastructure, facilities and buildings on site, and adjacent to site and harm to people.	Subsidence has occurred near the mine site previously. SRK Consulting (2018) and Wardell Armstrong (2018) investigated ground subsidence which occurred in 2018. Their conclusions were that pumping of water to Drumgoosat affected the stability of the pillars, the collapse area is contained within the area of subsidence and the mine workings under the roads R179 and L4900 are stable. Wardell Armstrong (WA) were able to confirm the conclusions reached by SRK, that large scale movement of the surface outside of the main subsidence area was unlikely and that the support of the two roads, the R179 and the L4900, was intact and robust. Predictive numerical modelling by SRK Consulting (2018) indicates that the mine is stable below the cross sections analysed for both the average and weakened gypsum strength cases. SRK Consulting (2018) suggest <i>"none of the areas analysed have been affected by the subsidence event that has taken place below the GAA playing fields. Providing the mine water level is not allowed to increase and submerge the pillars in the areas analysed it is highly unlikely that the gypsum pillars will deteriorate to an extent that will result in failure of the mine pillars"</i>. The emergency response procedure for the site states in the event of a ground collapse its recommended to immediately leave the area if in a working part of the mine. An above ground assessment of the areas where ground has moved is required and persons are restricted from entering the area. The relevant national bodies including the Health and Safety Authority, EPA and County Council and Gardai are contacted where required. Public safety is prioritised. An assessment must be taken to determine if the incident has had an environmental impact on the local area and if an environmental impact is possible a risk assessment is completed to identify sources and measures put in place to prevent the impact to the environment.	SRK Consulting (2018) and Wardell Armstrong (2018) investigated ground subsidence which occurred in 2018 and concluded the collapse area is contained within the area of subsidence and the mine workings under the roads R179 and L4900 are stable. SRK Consulting (2018) also concluded <i>Providing the mine water level is not allowed to increase and submerge the pillars in the areas analysed it is highly unlikely that the gypsum pillars will deteriorate to an extent that will result in failure of the mine pillars"</i> Mine water is no longer diverted to the underground mine and will no longer be stored in the underground mine. The Proposed Licence Amendment looks to increase the sulphate ELV to facilitate the release of water removing the need to divert water on site in turn reducing the risk associated with the potential for ground collapse and or subsidence. No further assessment required.

The emergency response procedure considered within the above table was taken from the EPA licencing website and was dated 05/03/2019.

Table 16-3 Summary of Potential Natural Disasters

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning for Scoping In/Out of Assessment
Earthquake / Seismic Event	The risk of earthquakes in Ireland is very low, but seismic events could result in asset damage to the facilities on the mine and factory site and the potential for subsequent fires and explosions if gas pipelines were damaged. An earthquake could potentially result in a fracture through which groundwater could seep into an underground working mine where the water could come in contact with gypsum, potentially increasing sulphate levels in water being discharged from the mine.	The Irish National Seismic Network has a number of monitoring stations, including one south of Dublin and to the North of Dundalk. No significant earthquakes or seismic activity have occurred in recent years³³. The most recent seismic activity occurred east of Kingscourt and was identified as a quarry blast³⁴.	The risk of earthquakes in Ireland is very low. No significant earthquakes or seismic activity has been reported in recent years. In addition the Proposed Licence Amendment will not result in an increase in earthquakes. The on-site emergency response procedure includes a procedure for unexpected ingress of water to a mine. Should water ingress occur and sulphate levels increase resulting in exceedance of an ELV the Applicant would investigate the cause of increase and would implement mitigation measures to prevent a reoccurrence. The EPA and other relevant stakeholders would be contacted. Any quality control system is to be in line with section 6.13.3 of IEL P0519-03. No further assessment required as the Proposed Licence Amendment will not result in an increased risk of earthquakes and no large seismic events have occurred in recent years within Ireland.

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³³ <https://www.insn.ie/recent-local-earthquakes/>

³⁴ <https://www.insn.ie/events/>

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning for Scoping In/Out of Assessment
Climate Change – Temperature Extremes -Reduced Flow	Dryer summers could lead to further reduced flows in streams during summer months reducing the dilution capacity of streams at discharge points at the mine and factory sites at varying times of the year.	A reduction in flowrates may increase the concentration of sulphate but would not increase the mass of material entering the river(s). Should changes in flow regimes occur in the River Bursk or the Glyde River as a result of climate change or other factors, the Applicant would carry out a risk assessment to identify any potential impacts and mitigation measures if required. Improvements in technologies for the treatment of sulphate should be reviewed on a 5yr basis and mitigation implemented if required. The site emergency procedures should be updated regularly to account include procedures to be implemented should an ELV exceedance occur.	The Proposed Licence Amendment is unlikely to impact upon climate change. Should climate change alter the flow of the River Bursk or the River Glyde, a risk assessment should be carried out and any identified mitigation put in place. Alternatives are considered in Chapter 2 of this report. Improvements in technologies for the treatment of sulphate should be reviewed on a 5year basis and mitigation implemented if required. The site emergency procedures should be updated regularly to account include procedures to be implemented should an ELV exceedance occur Potential impacts of existing sulphate levels are considered in Chapter 5 Population and Human Health, Chapter 6 Biodiversity and Chapter 8 Hydrology and Hydrogeology. Although a large release of sulphate could result in localised impacts it is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident. However this should be reviewed in the future should climate change alter the flow of the River Bursk or the River Glyde. No further assessment currently required.
Climate Change – Temperature Extremes -Storm events / Flooding	Increased potential for flooding resulting from climate change, more frequent extreme weather events and increased water levels.	The site is located inland. OPW Flood Maps³⁵ flood extents do not extend to the mine or factory sites; however past flood events have been identified within the wider area. A flood event was identified in Magheracloone in 1999 within the Glyde catchment.	Based on OPW Flood Maps no past flood events have occurred at the mine or factory site and it was not impacted by the flood event recorded identified in Magheracloone in 1999 In addition the sites emergency response plan considers the potential for water ingress from unidentified source and has included measures to reduce potential impacts should this event occur. The Proposed Licence Amendment will not impact upon climate change. No further assessment required.
Bomb Threat or Security Threat	The impact of a bomb or security threat on the site could lead to a major accident with the potential for significant injuries to people and damage to assets, both onsite and offsite.	The emergency response procedure for the site includes a procedure should an unexplained explosion occur. The site will be evacuated if required and access to the site controlled.	An increase in the sulphate ELV at Compliance Point CP-1 would not alter the procedure in place should a bomb threat or security threat occur and would not increase the likelihood of such an event occurring. In light of this this has not been considered further. No further assessment required.

³⁵ <https://www.floodinfo.ie/map/floodmaps/>

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning for Scoping In/Out of Assessment
Lightning	A lightning strike could cause a major accident, harm to people onsite and damage to site infrastructure. Lightning could also present a source of ignition to flammable materials such as diesel. A subsequent major fire could harm people both onsite and offsite.	The engineering design of the facility should incorporate the appropriate electrical earthing and bonding systems were required on mechanical and electrical systems. The design, inspections and maintenance of these systems would reduce the likelihood of a major accident being initiated by a lightning strike to a very low level.	An increase in the sulphate ELV at Compliance Point CP-1 would not be influenced by a lightening event. Should general power failure or a fire occur following a lightning strike both fire and power failure are considered within the site's emergency response procedure. It is AECOMs understanding that in the event of power loss pumping of water from holding areas to discharge points would cease and excess surface water run-off in proximity to the open pit mine is likely to drain into the open pit mine. The open pit mine water requires pumping for water to enter the lagoons. Additionally, the lagoons are located away from the River Bursk and water release is controlled by a pump and alarm system. Should an exceedance of an ELV occur the Applicant would investigate the cause of increase and would implement mitigation measures to prevent a reoccurrence. The EPA and other relevant stakeholders would be contacted. Any quality control system is to be in line with section 6.13.3 of IEL P0519-03. Although a large release of sulphate could result in localised impacts but is considered unlikely to result in a major accident that could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident.
Aircraft / Drone Strike	Dublin airport is located approximately 60 km north west of the mine site, although unlikely, the impact of an aircraft crash on the site would be a major accident with the potential for significant injuries to people and damage to assets, both onsite and offsite	The site is located in an area which does not have a high density of air traffic. The facilities at the mine and factory site are unlikely to withstand such an impact. Consequently, vigilance and security systems are the key mitigation measures.	A strike on the mine or factory site is not anticipated to result in an increase in sulphate at compliance points as the level of sulphate would relate to groundwater flow through gypsum or stormwater coming in contact with gypsum. No further assessment required.

Table 16-4 Summary of Potential Major Accidents Identified at the Mine Site

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning for Scoping In/Out of Assessment
Diesel Storage Failure of Tanks/Bund Leading to Release Of Diesel.	Mine Site: Contamination of open ground surrounding hard standing at the diesel fill, migration of diesel to groundwaters, contamination of stormwaters in settlement lagoons / discharge to the River Bursk (KD Environmental Ltd 2019).	Mine Site: The KD Environmental Ltd (2019) Environmental Liabilities Risk Assessment notes bund testing occurs every 3 years, there is an emergency response team on site and there are spill kits on site. The tank was considered by KD Environmental Ltd (2019) to be of good condition and separate from other site activity reducing the potential for collisions to occur. The bund is not hydrostatically tested but is visually inspected by a structural engineer.	An increase in the sulphate ELV at Compliance Point CP-1 would not alter diesel storage on site. A number of measures are also in place to reduce potential impacts. In light of this this has not been considered further and is Scoped Out for assessment
Diesel Use Failure of Diesel Pump-Line During Operation Leading To Release of Diesel	Mine Site: Contamination of open ground surrounding hard standing at the diesel fill, migration of diesel to groundwaters, contamination of stormwaters in settlement lagoons / discharge to the River Bursk (KD Environmental Ltd 2019).	Mine Site: A number of mitigation measures were suggested by KD Environmental Ltd (2019) within the Environmental Liabilities Risk Assessment report including the upgrading of an interceptor from Class 2 to Class 1 and weekly above ground pipeline checks.	An increase in the sulphate ELV at Compliance Point CP-1 would not result in an increase in fuel use and would not require changes any existing mitigation currently in place. A number of measures are also in place to reduce potential impacts. In light of this this has not been considered further and is Scoped Out for assessment
Diesel Delivery Collision on Site Releasing Diesel Tanker Contents	Mine Site: Contamination of open ground where spill occurs leading to groundwater contamination, diesel entering the stormwater drains and leading to contamination of the lagoons and to a breach of the ELV (KD Environmental Ltd 2019).	Mine Site: KD Environmental Ltd (2019) note there is a traffic management plan in place on site which includes speed limits and no mobile phones are allowed whilst driving on the site.	An increase in the sulphate ELV at Compliance Point CP-1 would not require a change to the amount of fuel required on site and would not require a change to the existing delivery procedure. A number of measures are also in place to reduce potential impacts. In light of this this has not been considered further and is Scoped Out for assessment
Oil and Chemical Storage Failure of Bund Releasing Oils and Chemicals	Mine Site: Contamination of open ground surrounding hard standing at the storage bund, migration of oils and chemicals to groundwaters, contamination of stormwaters in settlement lagoons / discharge to the River Bursk. The chemical and drum storage bund is at an elevated position with open ground to the back (KD Environmental Ltd 2019).	Mine Site: KD Environmental Ltd (2019) note the storage tank is in good condition and separated from other site activity reducing collision risks and bund integrity testing occurs every 3 years.	An increase in the sulphate ELV at Compliance Point CP-1 would not require a change to the oil or chemical storage procedures on site. A number of measures are also in place to reduce potential impacts. In light of this this has not been considered further and is Scoped Out for assessment.
Oil and Chemical Storage Corrosion of Drums Releasing Oils and Chemicals.	Mine Site: Contamination of open ground surrounding hard standing at the storage bund, migration of oils and chemicals to groundwaters, contamination of stormwaters in settlement lagoons / discharge to the River Bursk. The chemical and drum storage bund is at an elevated position with open ground to the back (KD Environmental Ltd 2019).	Mine Site: KD Environmental Ltd (2019) note the drums are provided by the manufacturer who are required to produce the drums to meet legislation requirements ensuring they are in good condition and fit for purpose. When on site the drums are banded.	An increase in the sulphate ELV at Compliance Point CP-1 would not require a change to the oil or chemical storage procedures on site. Drums are banded when on site and should continue to be banded. In light of this this has not been considered further and is Scoped Out for assessment.
Fuel Use Failure of Above Ground or Underground Pipeline Releasing Oils and Chemicals.	Mine Site: Contamination of open ground surrounding hard standing at the storage bund, migration of oils and chemicals to groundwaters, contamination of stormwaters in settlement lagoons / discharge to the River Bursk. Oil pipelines run over open ground KD Environmental Ltd 2019).	Mine Site: KD Environmental Ltd (2019) note that an inspection of above ground pipelines is carried out by onsite maintenance staff weekly, however this may not protect against large oil leaks from pipelines.	An increase in the sulphate ELV at Compliance Point CP-1 would not require an increase in fuel use and would not impact upon site emergency procedures. In light of this this has not been considered further and is Scoped Out for assessment.

Major Accident / Disaster	Risks / Effects	Prevention / Mitigation	Reasoning for Scoping In/Out of Assessment
Fire at Oil/Chemical Storage Area/Bund	A major pool fire caused by a release of fuel oil into the bund which ignites could generate high levels of thermal radiation and plumes of smoke. Personnel working in external areas of the site could be harmed and this could also potentially result in damage to site buildings. It is considered unlikely that this would have a significant effect on any concrete structural sections of the facilities on site.	There is a trained environmental response team on site, KD Environmental Ltd (2019) identified the storage tank at the mine site was in good condition and KD Environmental Ltd (2018) note the chemical and drum storage area at the factory site is internally located.	An increase in the sulphate ELV at Compliance Point CP-1 would not impact upon site emergency procedures. In light of this this has not been considered further and is Scoped Out for assessment.
Failure of Interceptor Releasing Oils / Chemicals Causing Groundwater and Land Contamination	Mine Site: Release of oils to stormwater lagoons and risk of breaching the ELV at the discharge point. As no alarm is fitted on the interceptor a failure may not be detected until after contamination has occurred (KD Environmental Ltd 2019).	Mine Site: KD Environmental Ltd (2019) noted the maintenance of the interceptor was on the PM List and that the interceptor was class 2 but is required to be class 1 as per IED P0519-03 requirements. This point requires to be clarified.	An increase in the sulphate ELV at Compliance Point CP-1 would not require a change to the existing infrastructure. In light of this this has not been considered further and is Scoped Out for assessment.
Spill on Site	Potential contamination of stormwater, groundwater, onsite lagoons and/or land in the area where the spill occurs. This could lead to pollution of streams should contaminated stormwater reach discharge points.	The emergency response procedure for the site includes a procedure for spills <5L of non-hazardous material, other spills >5L of non-hazardous material or hazardous material. Where spills occur checks are done to identify if there are storm drains in the area. A procedure is in place should the spill be near storm drains. Material Safety Data Sheets (MSDS) for chemicals are available at various points around the site. Spill kits are available on site. If a spill enters a storm drain or a river the EHS Manager must contact the EPA, local authorities and the Fisheries Board	An increase in the sulphate ELV at Compliance Point CP-1 would not alter the response to spills on site or increase the occurrences of spills on site. In addition the site emergency response procedure considers the potential occurrence for spills on site and spill equipment is stored around site. In light of this this has not been considered further and is Scoped Out for assessment.
Gas Leak	Potential to lead to a fire on site should an ignition source be in the vicinity of the leak. This could potentially injure people and damage assets.	The emergency response procedure for the site includes a procedure for staff to follow should a gas main rupture. Any open flames or sources of ignition are to be extinguished. The emergency response team are to be contacted. The emergency response team will isolate at designated points if required and the area will be evacuated. In an emergency situation isolation of natural gas supply to the Kingscourt works can be isolated at six locations, 4 along the supply line, 2 at remote locations.	An increase in the sulphate ELV at Compliance Point CP-1 would not alter the procedure in place should a gas leak occur and would not increase the likelihood of such an event occurring. In light of this this has not been considered further and is Scoped Out for assessment
Unplanned Explosion	Uncontrolled explosion due to error in blasting operations in underground mine	The emergency response procedure for the site includes a procedure should an unexplained explosion occur.	An increase in the sulphate ELV at Compliance Point CP-1 would not alter the procedure in place should an unexplained explosion occur and would not increase the likelihood of such an event occurring. In light of this this has not been considered further and is Scoped Out for assessment
General Power Failure	Power failure leading to failure of stormwater release controls, contamination of surface waters and failure to meet ELV	An emergency lighting system is installed on site and is activated in the event of power general power failure. The main gas supply lines to both the plaster mill and board plant isolates automatically. Engineers determine if arrangements are required to shut down equipment. The fire pump is powered electrically and so will be unavailable during a power outage	An increase in the sulphate ELV at Compliance Point CP-1 would not alter the procedure in place should a general power failure threat occur and would not increase the likelihood of such an event occurring. No additional power is required. In light of this this has not been considered further and is Scoped Out for assessment.

16.5 Emergency Management

Some of the mitigation measures described in Table 16-3 Table 16-2 and Table 16-4 contain references to the emergency response procedure for the site. It is AECOMs understanding this document is regularly updated to incorporate new and revised procedures. The emergency response procedure contains plans for the response to emergencies on site including fires, water ingress from unidentified sources and ground collapse / subsidence. All personnel on site should receive training in the contents of the emergency response procedure, be aware of their responsibilities during emergency events and participate in regular training exercises. Emergency critical roles include personnel trained to use fire suppression systems and roles relating to the emergency response team present on site.

The EPA has recently published revised guidance on firewater containment in November 2019 these should be considered with the emergency response procedure.

The emergency response procedure will be reviewed by the Applicant should the Proposed Licence Amendment be granted. The revised emergency response procedure should also include the Applicants procedure for monitoring pollutant concentrations and the response procedure to any exceedances. The operational procedure should also be updated to include a consideration of trends in concentration over time.

16.6 Mitigation Measures

No additional mitigation measure have been identified above those included within Table 16-3, Table 16-2 and Table 16-4. However should reductions in flow occur in the River Bursk or the River Glyde as a result of climate change the Applicant should carry out a risk assessment to identify any potential impacts relating to sulphate and electrical conductivity levels in discharges to surface waters and possible mitigation measures. Mitigation measure are already in place at the mine and factory site. These should be reviewed frequently by the Applicant and updated as required. All staff should receive training on the contents of the emergency response procedure for the mine and factory site.

16.7 Cumulative Impacts

Six licensed facilities (P0519, P0806, P0065, P0528, P0037 and P0371) and one waste facility (W0195) are located within a 10 km radius of the site. Of these, one EPA licensed facility (P0866-01) is within a 1 km radius of the site. The registered licensed activity, P0866-01 is for the rearing of poultry in installations where the capacity exceeds 40,000 places. The site does not have emissions to water or onsite disposal of materials as part of its licence.

The cumulative impact of these site from a water perspective has been considered in Chapter 8 Hydrology and Hydrogeology. Surface water monitoring point SW16 is downgradient of Breedon Brick and Lissaden Towels and so discharges from these facilities would be considered at this pointing point.

The facilities listed above are licenced facilities and as such would be required to adhere to any ELV, and monitoring requirements as set out within the licence for the facility. The results of the monitoring would be shared with the EPA as set out within the licences. In addition each facility should have an emergency response procedure in place which is adhered to should an emergency on site occur and environmental liability assessments will likely have been carried out for these facilities. Taking this into consideration cumulative or domino impacts with the facilities outlined have not been identified.

The Proposed Licence Amendment will not alter the operations associated with the mine and factory sites and associated facilities or introduce any new source of MA&D. The impacts of sulphate levels on the Biodiversity, Population and Human Health and Hydrology and Hydrogeology are considered in Chapter 5, Chapter 6 and Chapter 8 of this report.

No cumulative impacts from a MA&D point of view are anticipated from the Proposed Licence Amendment.

16.8 Residual Impacts

No residual impacts were identified.

16.9 Summary

This Proposed Licence Amendment does not look to alter any of the operations associated with the mine and factory sites. The Proposed Licence Amendment relates to an increase in the ELV for sulphate and electrical conductivity at Compliance Point CP-1. No additional facilities or infrastructure is required to facilitate the Proposed Licence Amendment.

A number of potential MA&D were considered in Table 16-3, Table 16-2 and Table 16-4 based on environmental liability reports produced for the Applicant by KD Environmental Ltd and taking into consideration the emergency response procedure in place on site. The conclusions of this assessment are that the increase in sulphate concentration does not have the potential to initiate or intensify a major accident or disaster and there is no demonstrable harm to human health. However, some further assessment and considerations were identified during the assessment and these are summarised below.

An emergency response procedure is in place at the mine and factory sites. This procedure should consider the EPA published revised guidance on firewater containment (2019) and should be reviewed by the Applicant should the Proposed Licence Amendment be granted. The revised emergency response procedure should also include the Applicants procedure for monitoring pollutant concentrations and the response procedure to any exceedances. The emergency response procedure should be updated regularly and all personnel on site should receive training in the contents of the emergency response procedure, be aware of their responsibilities during emergency events and participate in regular training exercises.

Further studies required include an assessment of firewater containment and should reductions in flow occur in the River Bursk or the River Glyde as a result of climate change, the Applicant should carry out a risk assessment to identify any potential impacts relating to sulphate levels in discharges to surface waters and possible mitigation measures. Trends in sulphate concentration and electrical conductivity and environmental factors should be considered over time and assessed throughout the lifetime of the mine site. Alternative methods of managing sulphate on site were considered in Chapter 2 of this report however none were considered viable at this time. Improvements in technologies for the treatment of sulphate should be reviewed on a 5 year basis and mitigation implemented should a viable option become available.

A requirement for further monitoring has been identified within Chapter 6 Biodiversity and Chapter 8 Hydrology and Hydrogeology. This would implement monitoring of water quality on a regular on-going basis in the River Glyde a short distance upstream of Ballyhoe Lough pNHA and would require the Applicant to liaison with EPA / NPWS and to consider further action should an exceedance occur.

17 Interactions of the Forgoing

17.1 Introduction

This chapter of the EIAR evaluates the potential interaction of impacts described within this EIAR, which the Proposed Licence Amendment may have on the receiving environment and sensitive receptors. The Proposed Licence Amendment would result in an increase in the current compliance limit value for sulphate from the current level of 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 $\mu\text{S}/\text{cm}$ to 2,360 $\mu\text{S}/\text{cm}$ at Compliance Point CP-1 (in the River Bursk at the mine site). The current limit of 200 mg/L is outlined within IEL P0519-03, the IEL for both the mine and factory sites.

As a requirement of the Environmental Impact Assessment Directive 2011/92/EU, as amended by Directive 2014/52/EU, and considering best practice guidelines and advice notes, the inter-relationships between the following individual factors must be identified and assessed: population and human health; biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC; land and soil, water, air and climate, noise and vibration, material assets, cultural heritage, waste and the landscape.

In accordance with this and to align with the environmental aspects assessed in this EIAR, a summary of the interactions (or inter-relationship) of impacts identified from the Proposed Licence Amendment between the following environmental aspects are outlined in this chapter:

- Population and Human Health
- Biodiversity
- Hydrology and Hydrogeology
- Climate, and
- Major Accidents and Disasters.

Detailed impact assessments were not undertaken for land and soils, air quality, noise and vibration, landscape and visual, cultural heritage, material assets, and waste; as potential for significant effects on the existing environment are not anticipated. Therefore, these environmental factors have not been considered in this chapter.

Specific monitoring measures have been outlined within respective chapters within this EIAR and as such no additional mitigation is proposed in this chapter.

17.2 Population and Human Health

17.2.1 Hydrology and Hydrogeology

An increase in sulphate associated with the Proposed Licence Amendment could have the potential to effect on population and human health should increase sulphate impact upon drinking water resources. Consideration is given to drinking water recourse in Chapter 8 Hydrology and Hydrogeology.

While, modest riverbed infiltration cannot be excluded, this would be limited to shallow groundwater locally and the volume infiltrated over such a short distance is unlikely to affect the overall groundwater quality. It is therefore considered unlikely that any impact on local groundwater abstractions would be affected by the increased sulphate discharge. Tallanstown pumping station is located circa 18 km downstream of Compliance Point CP-1. Water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Therefore, it is concluded that there will be a not significant effect on the receptors considered.

In terms of groundwater receptors The laboratory data reviewed indicates that the limit of 187.5 mg/L as set by groundwater regulations was never exceeded at SW12 and SW16. However, the estimated concentration at SW12 (assuming 1,250 mg/L of sulphate at Compliance Point CP-1) would be above this limit. While, modest riverbed infiltration cannot be excluded, this would be limited to shallow groundwater locally and the volume infiltrated over such a short distance is unlikely to affect the overall shallow groundwater quality. Therefore, it is concluded that there will be an imperceptible effect on the receptors considered.

17.3 Biodiversity

17.3.1 Population and Human Health

The Proposed Licence Amendment may have potential impacts on the freshwater aquatic environment (see Chapter 6: Biodiversity). It is expected that implementation of mitigation measures would be adopted to prevent and minimise potentially significant effects. Such effects are considered to have limited scope to impact on human health.

17.3.2 Hydrology and Hydrogeology

A direct link exists between Hydrology and Hydrogeology, and Biodiversity. Any change in hydrology has the potential to directly impact biodiversity on a local, county or national scale. A change in water quality, water flow rate, sediment load amongst others all have the potential to impact aquatic ecosystems.

Overall, the concentration of sulphate is observed to increase downstream of the point of discharge at the mine site. Based on the continuous monitoring data for the period of 2019, the average concentration of sulphate increases from 59 mg/L (at point B) to 191 mg/L (at Compliance Point CP-1). Based on the modelling exercise carried out in which the concentration recorded at Compliance Point CP-1 is assumed to be 1,250 mg/L (the proposed revised ELV), the estimated concentration at SW12 (5.6 km downstream) would be between 256.99 mg/L with an upper prediction limit of 352.01 mg/L and a lower prediction limit of 161.96 mg/L indicating that the impact would be limited to this initial stretch of the stream. However, it is noted that the significant drop in concentration observed between Compliance Point CP-1 and SW12 would likely be associated with the influx from the catchment of GLYDE_10 which merges with the GLYDE_30 approximately 2 km downstream of the point of Compliance Point CP-1. It can therefore be inferred that, in a worst-case scenario, only approximately 2 km of stream would display annual average concentrations greater than 250 mg/L. This would indicate that the significance of the impact on water quality is low to negligible. Therefore, it is concluded that there will be a not significant effect on the receptors considered.

17.3.3 Climate

The Proposed Licence Amendment would also have no additional land requirements that could result in the loss of carbon sinks, such as forests, woodland and vegetation as the operational area is currently functioning as an active mine and no changes are proposed to accommodate the change.

17.3.4 Major Accidents and Disasters

There is potential for increased sulphate levels to occur within streams such as the River Bursk and the River Lagan at discharge and compliance points with the potential to impact the biodiversity of the streams. This is discussed in Section 16.4 of Chapter 16 MA&D and has been assessed under Chapter 6 Biodiversity.

The Proposed Licence Amendment as set out within this document looks to increase the ELV for sulphate from 200 mg/L to 1,250 mg/L and for electrical conductivity from 1000 μ S/cm to 2,360 μ S/cm at Compliance Point CP-1 at the mine site. Should this amendment be facilitated the worst case scenario to date at CP-1 (998 mg/L on the 28/10/18) would not be above the licenced amount of sulphate allowed to be discharged. The onsite emergency response procedure in place would alert site operators to increased sulphate concentrations at CP-1 should water ingress from unidentified source occur at an underground mine

In addition Chapter 5 Population and Human Health and Chapter 8 Hydrology and Hydrogeology have considered the potential impacts of the increase in sulphate at the Tallanstown drinking water abstraction point. Chapter 8 Hydrology and Hydrogeology determined there will be a not significant effect on the receptors considered. Chapter 5 Population and Human Health concluded water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Where an exceedance is noted this would affect taste rather than posing a health risk.

Additional monitoring has also been proposed as part of the biodiversity and Hydrology and Hydrogeology assessment within Chapters 6 Biodiversity and Chapter 8 Hydrology and Hydrogeology of this report.

Taking the above into consideration and with all the existing and proposed site risk reduction measures in place no further assessment was considered to be required from a MA&D perspective. It should also be noted that a release

of sulphate is considered unlikely to result in a major accident which could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident

17.4 Hydrology and Hydrogeology

17.4.1 Population and Human Health

An increase in sulphate associated with the Proposed Licence Amendment could have the potential to effect population and human health should increase sulphate impact upon drinking water resources. A known drinking water abstraction (Tallanstown pumping station) is located circa 18 km downstream of Compliance Point CP-1 (see Chapter 8: Hydrology and Hydrogeology). However, water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Where an exceedance is noted this would affect taste rather than posing a health risk.

In addition based on the modelling exercise carried out as part of Chapter 8 Hydrology and Hydrogeology in which the concentration recorded at Compliance Point CP-1 is assumed to be 1,250 mg/L (the proposed revised ELV), the estimated concentration at SW12 (5.6 km downstream) (see Figure 17-1) would be between 256.99 mg/L with an upper prediction limit of 352.01 mg/L and a lower prediction limit of 161.96 mg/L indicating that the impact would be limited to this initial stretch of the stream. However, it is noted that the significant drop in concentration observed between Compliance Point CP-1 and SW12 would likely be associated with the influx from the catchment of GLYDE_10 which merges with the GLYDE_30 approximately 2 km downstream of the point of Compliance Point CP-1. It can therefore be inferred that, in a worst-case scenario, only approximately 2 km of stream would display annual average concentrations greater than 250 mg/L. Tallanstown pumping station is located circa 18 km downstream of Compliance Point CP-1. Water monitoring data and estimated sulphate concentrations indicated that the supply is unlikely to be affected by the increased sulphate discharge. Therefore, it is concluded that there will be a not significant effect on the receptors considered.

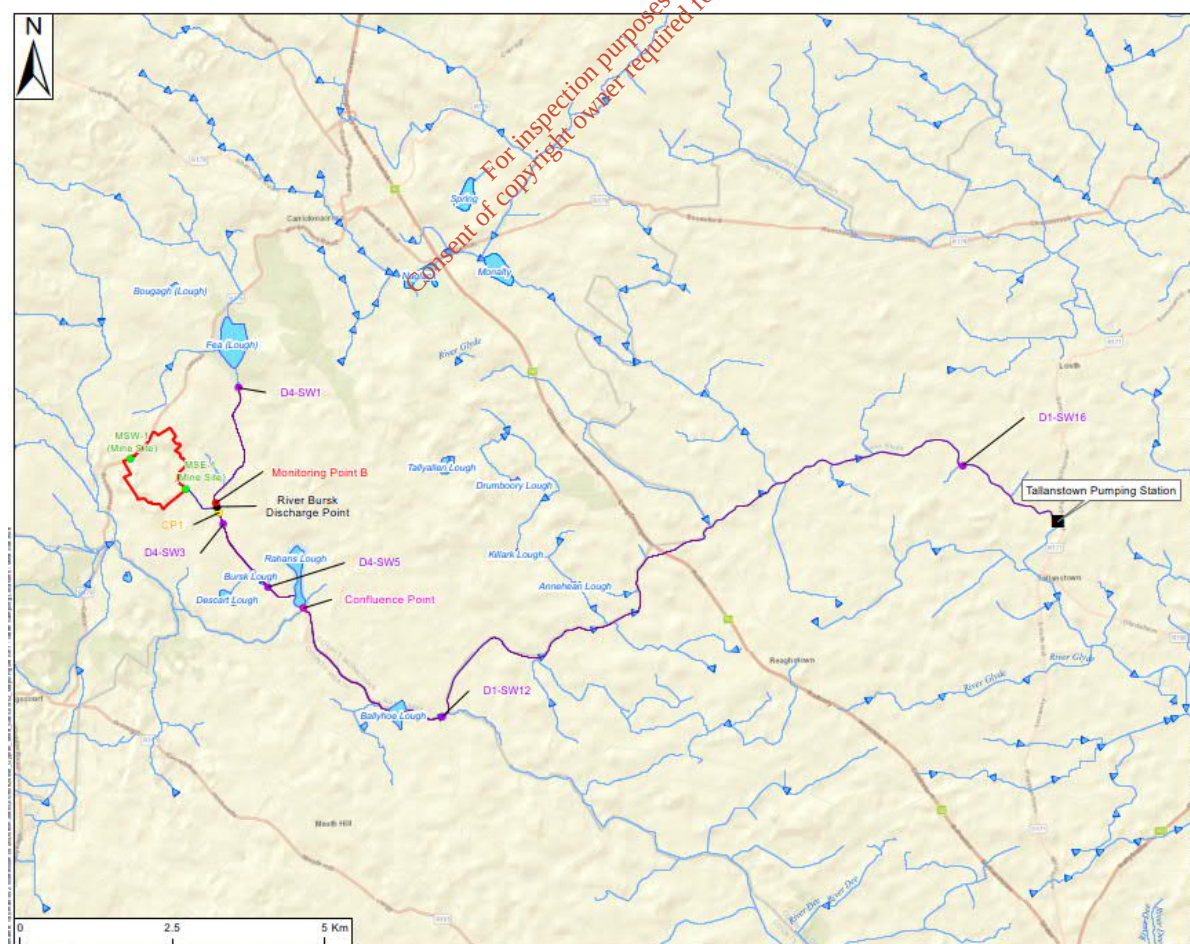


Figure 17-1 Water Sampling Locations – Mine Site (also see Volume 3, Appendix 8.1, Figure A8-1)

17.4.2 Biodiversity

As mentioned above a direct link exists between Biodiversity and Hydrology and Hydrogeology. Any change in hydrology has the potential to directly impact biodiversity on a local, county or national scale. A change in water quality, water flow rate, sediment load amongst others all have the potential to impact aquatic ecosystems

The potential impacts identified within Chapter 6 Biodiversity of this report are related to the potential impacts of increased concentrations of sulphate on vegetation diversity, the eggs and younger stages of coarse fish, macroinvertebrates.

Following the implantation of additional monitoring a possible permanent adverse effect of county significance was identified for general freshwater habitats, a possible permanent adverse effect of local significance to coarse fish populations, a permanent adverse effect of local significance on macroinvertebrates and possible permanent adverse effect of Site significance only on otter relating to effects on foraging resources.

No significant effect resulting from the Proposed Licence Amendment was identified on European designated sites or pNHA hydrologically connected to the mine and factory site.

However Chapter 8 Hydrology and Hydrogeology have concluded that from a Hydrology and Hydrogeology point of view the significance of the impact on water quality is low to negligible based upon modelling exercise carried out in which the concentration recorded at Compliance Point CP-1 is assumed to be 1,250 mg/L (the proposed revised ELV), the estimated concentration at SW12 (5.6 km downstream) would be between 256.99 mg/L with an upper prediction limit of 352.01 mg/L and a lower prediction limit of 161.96 mg/L indicating that the impact would be limited to this initial stretch of the stream. However, it is noted that the significant drop in concentration observed between Compliance Point CP-1 and SW12 would likely be associated with the influx from the catchment of GLYDE_10 which merges with the GLYDE_30 approximately 2 km downstream of the point of Compliance Point CP-1. Chapter 8 Hydrology and Hydrogeology therefore inferred that, in a worst-case scenario, only approximately 2 km of stream would display annual average concentrations greater than 250 mg/L. This would indicate that the significance of the impact on water quality is low to negligible.

17.4.3 Major Accidents and Disasters

There is potential to impact upon a water abstraction point on the River Glyde at Tallanstown an abstraction point for drinking water. This is discussed in Section 16.4 of Chapter 16 MA&D and has been assessed under Chapter 8 Hydrology and Hydrogeology.

Both the mine and factory sites are existing licenced sites under IEL P0519-03 and a number of mitigation measures are in place and adhered to on both sites. With all the existing and proposed site risk reduction measures in place no further assessment was considered required from a MA&D point of view. In addition a release of sulphate is considered unlikely to result in a major accident which could result in multiple fatalities and serious injuries and / or widespread damage to property and the environment as a result of a single incident.

17.5 Climate

17.5.1 Population and Human Health

Given its nature, the Proposed Licence Amendment is not expected to result in changes to the climate of the existing factory site (see Chapter 9: Air Quality and Chapter 10: Climate).

Therefore, the impact of the Proposed Licence Amendment on climate change as a determinant of human health and well-being is assessed to be neutral (0).

17.6 Summary

In summary no significant impacts are predicted from the interactions of the constituent elements of the Proposed Licence Amendment. No additional mitigation measures were identified beyond those already identified within individual chapters.

18 Mitigation, Monitoring and Further Studies

18.1 Introduction

The operational mine and factory sites are licenced under IEL P0519-03. This licence outlines a number of existing monitoring and reporting requirements to be adhered to by the Applicant as part of the day to day operations of the mine and factory sites. These monitoring and reporting requirements as well as mitigation measures outlined within previous EIAR such as that by Golder Associates Ireland (2017) should continue to be adhered to where they are still relevant and implemented by the Applicant. These measures have also been taken into consideration when identifying baselines and within the assessments of this report.

This chapter is a collation of the impacts assessed and the mitigation and monitoring measures (or commitments) identified within Chapters 4 to 16 of this EIAR. A number of measures have been identified to monitor the surrounding environment should the Proposed Licence Amendment come into effect and are summarised below.

18.2 Biodiversity

Potential impacts of the Proposed Licence Amendment on Biodiversity were identified in Chapter 6 of this report. While No significant effect resulting from the Proposed Licence Amendment was identified on European designated sites or pNHA hydrologically connected to the mine and factory site, potential impacts were identified on general freshwater habitats, fish populations, macroinvertebrate populations and otter. The assessment of these is detailed in Section 6.4 of Chapter 6 of this report.

Although it is thought likely that there will be no effect on Ballyhoe Lough pNHA, because expected mean monthly sulphate levels at D1-SW12 are lower than the mean monthly limit of 309 mg/L recommended in BC (2013) for the degree of water hardness in the River Glyde, predictions are based on limited data and as this site is of national importance by virtue of its designation at the national level further monitoring has been recommended. Therefore, monitoring shall take place as follows:

- Monitoring of water quality shall be implemented on a regular on-going basis in the River Glyde a short distance upstream of Ballyhoe Lough pNHA. 'Regular on-going basis' means at least five times per month at evenly spaced intervals (as recommended in BC (2013)), unless the mine water discharge ceases or is mitigated to much lower sulphate levels. Automated monitoring on a more frequent basis from which monthly means can be calculated should also be acceptable. This will confirm that the mean monthly concentration of sulphate in water entering the lough does not exceed 309 mg/L, and
- In the unlikely event that the quality of water entering Ballyhoe Lough pNHA exceeds the recommended mean monthly sulphate level of 309 mg/L recommended in BC (2013) at the level of water hardness in the River Glyde, then liaison with EPA / NPWS will take place to consider further action. Alternative methods of managing sulphate on site may then be required, which should be in line with any future improvements in technologies for the treatment of sulphate.

18.3 Hydrology and Hydrogeology

The impact assessment for Hydrology and Hydrogeology can be found in Chapter 8, Section 8.5 of this report. Although no significant impacts were identified it was noted that predictions are based on a limited data set and as a result further monitoring was recommended.

Additional monitoring is proposed in respect to the confluence of GLYDE_10. Monitoring shall confirm that the stretch of stream impacted above 250 mg/L of sulphate is limited to the section upstream of the confluence. Therefore, monitoring shall take place as follows:

- Weekly monitoring of water quality shall be implemented on a regular on-going basis in the GLYDE_30 a short distance downstream of the confluence with the GLYDE_10. This will confirm that the concentration of sulphate in the water downstream of this point does not exceed 250 mg/L, and

- Should the sulphate level be recorded above 250 mg/L at this location, appropriate investigative action shall be carried out in consultation with the EPA and corrective actions implemented as determined by the investigation findings and/or subsequent assessment.

It is noted that a similar monitoring regime is recommended in Chapter 6 Biodiversity. As such, a suitable location could be determined to fulfil both requirements.

18.4 Major Accidents and Disasters

A number of measures are already in place at both the mine and factory site that would reduce or mitigate risks associated with potential for accidents and disasters. These should continue to be implemented as part of the day to day operations of the mine and factory sites. Although the Proposed Licence Amendment is not anticipated to significantly impact upon MA&D a number of further assessment and considerations were identified during the MD&D assessment and these are summarised below.

Although an emergency response procedure is in place at the mine and factory sites this procedure should consider the EPA published revised guidance on firewater containment (2019) and should be reviewed by the Applicant should the Proposed Licence Amendment be granted. The revised emergency response procedure should also include the Applicants procedure for monitoring pollutant concentrations and the response procedure to any exceedances. The emergency response procedure should be updated regularly and all personnel on site should receive training in the contents of the emergency response procedure, be aware of their responsibilities during emergency events and participate in regular training exercises.

Trends in sulphate and electrical conductivity concentration and environmental factors should be considered over time and assessed throughout the lifetime of the mine site. Alternative methods of managing sulphate on site were considered in Chapter 2 of this report however none were considered viable at this time. Improvements in technologies for the treatment of sulphate should be reviewed on a 5 year basis and mitigation implemented should a viable option become available.

Further studies required include an assessment of firewater containment and should reductions in flow occur in the River Bursk or the River Glyde as a result of climate change, the Applicant should carry out a risk assessment to identify any potential impacts relating to sulphate levels in discharges to surface waters and possible mitigation measures.

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