Development for the further replacement of Fossil Fuel with Alternative Fuels and for use of Alternative Raw Materials
Natura Impact Statement

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Environmental Assessment **Built Environment**

Client: Irish Cement Ltd.

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Contents

1 Introduction

1.1 Background

Irish Cement Ltd (ICL) is seeking a 10 year permission to expand the use of alternative fuels and to allow for the use of alternative raw materials at Platin Cement Works facility, Duleek, County Meath. It has been determined that the proposed development constitutes strategic infrastructure development and a planning application is being made directly to An Bord Pleanála under section 37E of the *Planning and Development Act, 2000* (as amended).

Screening for Appropriate Assessment has been undertaken of the proposed development at Platin and its relationship with European Sites (refer to separate Screening for Appropriate Assessment Report). The Screening study concluded that, under the precautionary principle, it is not possible to rule out significant adverse effects on five European sites arising out of potential impacts on air and water quality receptors. For this reason it is necessary to undertake the Appropriate Assessment process.

The European Sites under appraisal in this Natura Impact Statement are as follows:

- River Boyne and River Blackwater SAC;
- Boyne Coast and Estuary SAC;
- Boyne Estuary SPA;
- River Boyne and River Blackwater SPA;
- River Nanny Estuary and Shore SPA.

This Natura Impact Statement is intended to provide the information required to assist An Bord Pleanála, the competent authority, to undertake a Screening Assessment and, if necessary, an Appropriate Assessment (AA). This will determine the effects, if any, on European sites, (also known as Natura 2000 Sites) (Special Areas of Conservation (SAC) and Special Protection Areas (SPA), designated for nature conservation). The potential impacts on European sites, both as a result of the proposed development and in-combination with other plans and projects, are appraised in this report.

Brady Shipman Martin was commissioned to undertake the study, which was carried out by Consultant Ecologist Matthew Hague CEnv MCIEEM.

The requirements for an Appropriate Assessment are set out under *Article 6 of the EU Habitats Directive (92/34/EEC)*, transposed into Irish law through the *European Communities (Birds and Natural Habitats) Regulations 2011* (SI No. 477 of 2011, known as the *Habitats Regulations*) and the *Planning and Development Act, 2000* (as amended).

2 Methodology

2.1 Baseline data collection and field visits

A desk-based assessment was undertaken of the site at Platin and the wider area. This focused on habitats and species that are listed as Qualifying Interests (QI) (in the case of SACs) and Special Conservation Interests (SCI) (in the case of SPAs) in the designations for the European sites as well as on the published Conservation Objectives for each European site. A number of field visits have also been undertaken, most recently on 3rd April 2017.

This report takes the following guidance documents into account:

- *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities* (Department of Environment, Heritage and Local Government, 2010 revision);
- *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*. Circular NPWS 1/10 & PSSP 2/10;

- *Assessment of Plans and Projects Significantly Affecting European sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (European Commission Environment Directorate-General, 2001);
- *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC*. Draft Guidance issued by the European Commission (April 2015).

Information was collated from the organisations and websites listed below:

- Data on European sites and rare and protected plant and animal species contained in the following databases:
  - The National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht (www.NPWS.ie);
  - The National Biodiversity Data Centre (NDBC) (www.biodiversityireland.ie);
  - BirdWatch Ireland (www.birdwatchireland.ie);
  - Bat Conservation Ireland (www.batconservationireland.org).
- Information on land-use zoning from the online mapping of the Department of the Environment, Community and Local Government (http://www.myplan.ie/en/index.html);
- Recent and historical OSi mapping and aerial photography;
- Information on the Rivers Boyne and Nanny, and other local watercourses from www.catchments.ie;
- Information on water quality in the area (www.epa.ie);
- Information on soils, geology and hydrogeology in the area (www.gsi.ie);
- Information on the status of EU protected habitats in Ireland (NPWS, 2013);
- National Biodiversity Plan 2011 – 2016 (Department of Arts, Heritage and the Gaeltacht, 2011);
- Draft 3rd National Biodiversity Action Plan 2017 – 2021 (Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, 2017);
- Meath County Development Plan 2013-2019;
- Louth Development Plan 2015-2021;
- Drogheda Borough Council Development Plan 2011 – 2017.

The report has regard to the following legislative instruments:

- Planning and Development, Act 2000, as amended;
- European Commission (EC) Habitats Directive 92/43/EEC;
- European Commission (EC) Birds Directive 2009/147/EC;
- European Communities (Birds and Natural Habitats) Regulations 2011 (SI no 477 of 2011).

Where relevant, information contained in the following documents has been reviewed:

- *Environmental Impact Assessment Report* prepared as part of the application for a 10 year permission for the further replacement of fossil fuels with alternative fuels and to allow for the introduction of alternative raw materials at the Cement Works Facility in Platin, County Meath (Arup, June 2017);
  - In particular, Chapter 5 (Biodiversity), Chapter 6 (Land, Soils, Geology and Hydrogeology), Chapter 7 (Water and Hydrology) and Chapter 8 (Air Quality and Climate), of the EIA Report are relevant to this report;
  - In addition, appendices to this NIS: Appendix 1 (Background to Appropriate Assessment); Appendix 2 (Firewater Risk Assessment); Appendix 3 (Emergency Response Procedures); Appendix 4 (Construction Environmental Management Plan); and Appendix 5 (Ecological and Sediment Study of the River Nanny) are relevant to this report.

2.2 Potential Zone of Influence

In ecological and environmental impact assessment, for the risk of an impact to occur there must be a 'source', such as a construction site; a 'receptor', such as a designated site for nature conservation; and a pathway between the source and the receptor, such as a watercourse that links the construction site to the designated site. Although there may be a risk of an impact it may not necessarily occur, and if it does occur, it may not be significant.

Identification of a risk means that there is a possibility of ecological or environmental damage occurring, with the level and significance of the impact depending upon the nature and exposure to the risk and the characteristics of the receptor.

In accordance with the National Roads *Authority Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA/TII, 2009 (Rev. 2), the Zone of Influence of a project may be defined as the ecological areas and features (*i.e.* the ecological resources/receptors) likely to be affected by the biophysical changes caused by the project, however remote from [the project]. From this it will be possible to establish a 'zone of influence' for the project that encompasses all of its potential impacts. There are no set recommended distances for projects to consider European sites as being relevant for assessment. Rather, NPWS (2010) recommends that *'the distance should be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects'*. As a rule of thumb, it is often considered appropriate to include all European sites within 15km.

In some instances where there are hydrological connections a whole river catchment or a groundwater aquifer may need to be included. Similarly, where bird flight paths are involved the impact may be on an SPA more than 15 km away. Taking this into account, as a starting point a search was carried out for all European sites within 15km of the study area at Platin. This search was then extended to ensure that all European sites with any potential links to the proposed development were accounted for in the study.

3 The study area and the proposed development

3.1 Study area and surrounding environment

The study area comprises the site at Platin Cement Works as defined by the site boundary for the proposed development (see Figure 1), as well as an appropriate distance outside the site (the Zone of Influence as defined in Section 2.2).

Due to the heavily disturbed industrial nature of the local environment within the curtilage of the cement works at Platin, there are no areas of natural or semi-natural habitats present on the site. In effect, other than small pockets of ornamental shrubs and recolonising bare ground, the footprint of the site is predominantly occupied by buildings, hard-standing and by bare ground between areas of operational plant.

Site areas proposed for development are located within the general developed footprint of the cement works. Outside of the site, the boundary of the cement works and of the adjoining quarry have been landscaped to provide dense maturing tree belts of primarily native species such as alder, ash, birch, willow, whitebeam, scots pine and rowan trees.

No fauna occur regularly on the proposed development site, other than feral pigeons that use the buildings for shelter.

A number of European sites are located within 15km of the proposed development site at Platin. An additional European site is located just beyond the 15km boundary. These European sites are listed in Table 1 and are shown in Figure 2.

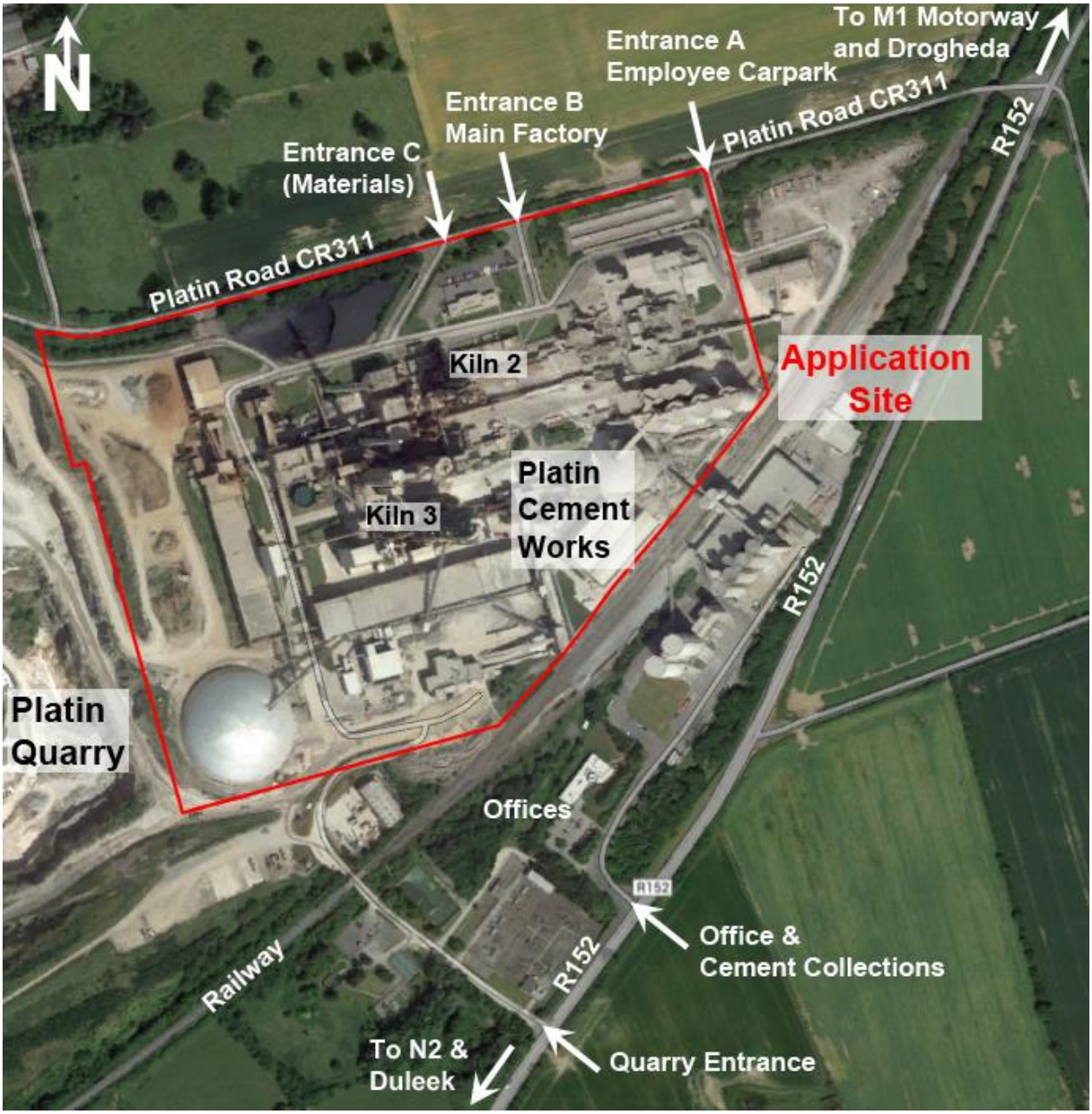

Figure 1 *Platin Cement Works and Application Site*

Table 1 Relevant European sites

European site	Site Code	Location (closest straight line distance from the development site at Platin)
Special Areas of Conservation		
River Boyne and River Blackwater	002299	3km to the north east
Boyne Coast and Estuary	001957	7km to the north west
Clogher Head	001459	15.2km to the north east. This site is outside the potential Zone of Influence of the proposed development by virtue of its location and qualifying

European site	Site Code	Location (closest straight line distance from the development site at Platin)
		interests. It is not necessary to consider the site further in this report.
Special Protection Areas		
Boyne Estuary	004080	5.5km to the west
River Boyne and River Blackwater	004232	3km to the north east
River Nanny Estuary and Shore	004158	8km to the west

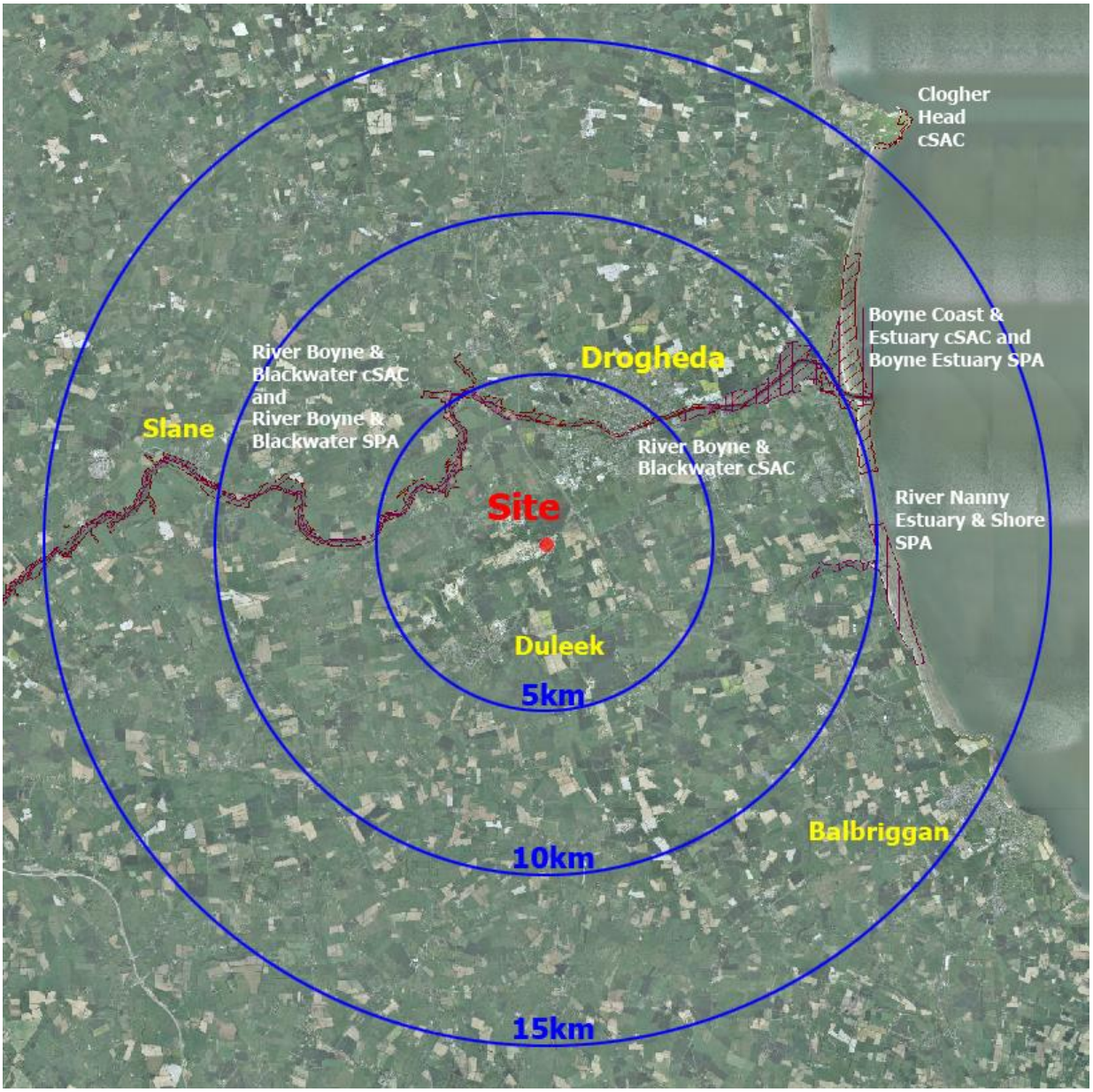

Figure 2 *European Sites in relation to the Study Area/Application Site*

3.2 Description of the proposed development

Irish Cement Limited is applying to An Bord Pleanála for a ten year planning permission for a strategic infrastructure development consisting of the further replacement of fossil fuels with lower carbon alternative fuels and for the use of alternative raw materials at Platin Cement Works, County Meath. Extant permissions already allow for the use of up to 120,000 tonnes per annum of a limited range of alternative fuels in Kiln 3. However, the proposed development seeks the flexibility to replace virtually all existing use of imported fossil fuels (*i.e.* up to 85% replacement) and for the use of alternative fuels in replacing a portion of traditional raw materials used in the manufacture of cement. In total this requires an additional 480,000 tonnes per annum of alternative fuels and alternative raw materials for use in both Kiln 2 and Kiln 3.

Following research on guidance by the Environmental Authorities in Switzerland and Germany, a range of potential materials have been selected as being suitable for use as alternative fuels or as alternative raw materials by cement plants. These materials include both non-hazardous and hazardous materials. The cement industry has been using these materials throughout Europe for more than 35 years and many of these materials are already licensed for use by the Environmental Protection Agency (EPA) for cement production in other cement plants in Ireland.

The proposed development consists of the provision of a range of buildings, structures, conveyors, plant and equipment for the further replacement of fossil fuels with alternative fuels and for the use of alternative raw materials in Platin Cement Works.

The application site, which extends to 22.5 hectares, is centrally located within Platin Cement Works. The Cement Works, which extends to circa 40 hectares, is located off the R152 Drogheda - Kilmoon Cross Regional Road, approximately 750m southwest of Junction 8 (Drogheda South) on the M1 Dublin Belfast Motorway. Platin limestone quarry is located directly west of the Cement Works and provides the primary raw material used in the manufacture of cement.

Platin Cement Works is regulated under the Industrial Emissions (IE) Directive and operates in accordance with IE Licence No. P0030-04, which is issued and monitored by the Environmental Protection Agency (EPA).

3.3 Links to European Sites

According to the draft Guidance published by the EC (*Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC*, dated April 2015) the "integrity of a site" relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect the site only in a visual sense or only affect habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3).

In other words, if none of the habitat types or species for which the site has been designated is significantly affected then the site's integrity cannot be considered to be adversely affected.

Platin Cement Works is not under any wildlife or conservation designation. Furthermore, no rare, threatened or legally protected plant species, as listed in the *Irish Red Data Book*, the Flora *Protection Order*, 2015 or the *EU Habitats Directive*, are known to occur within the site. Neither the site nor its immediate surroundings contain any habitats of ecological value. No Key Ecological Receptors (defined in accordance with the ecological resource valuations presented in the National Roads *Authority Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA/TII, 2009 (Rev. 2))) have been recorded.

No evidence of any species or habitats with links to European sites has been recorded at Platin Cement Works and no 'reservoir' type habitats are present. As a consequence of any development there will therefore be no loss of any habitat or species listed as a Qualifying Interest or Special Conservation Interest of any designated site.

All of the European sites identified in this report are at such a distance from the proposed development site that there would not be any significant effects on them as a result of:

- Habitat loss and/or fragmentation;
- Impacts to habitat structure;
- Disturbance to species of conservation concern;
- Mortality to species (such as roadkill);
- Noise pollution.

These specific potential impacts on European sites will not arise as a result of the proposed development and were therefore screened out following the Appropriate Assessment Screening Exercise.

It is however considered that the proposed development site (the impact 'source') is potentially linked with the European sites (the 'receptors') associated with the Rivers Boyne and Nanny, including the coastal European sites, as described in Table 2, as a result of the following potential impacts, that may arise during both the construction and operational phases of the proposed development:

- Emissions to water;
- Emissions to air.

The Appropriate Assessment Screening exercise undertaken therefore concluded that it cannot be excluded that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.

Table 2 Relevant European sites including reasons for designation

European Site	Reasons for designation (information correct as of July 2017) (*denotes a priority habitat)	Source-Pathway-Receptor
Special Areas of Conservation		
River Boyne and River Blackwater SAC (002299)	•Alkaline fens [7230] •*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno padion*, *Alnion incanae*, *Salicion albae*) [91E0] •Atlantic Salmon *Salmo salar* (only in fresh water) [1106] •River Lamprey *Lampetra fluviatilis* [1099] •Otter *Lutra lutra* [1355] Generic Conservation Objectives: 15/08/16 According to this SAC's Natura 2000 information form, this site comprises most of the freshwater element of the River Boyne from upriver of the Boyne Aqueduct at Drogheda, the Blackwater River as far as Lough Ramor and the principal Boyne tributaries, notably the Deel, Stoneyford and Tremblestown Rivers. This system drains a considerable area of Counties Meath and Westmeath and smaller areas of Cavan and Louth. The underlying geology is Carboniferous Limestone for the most part with areas of Upper, Lower and Middle well represented. In the vicinity of Kells Silurian Quartzite is present while close to Trim are Carboniferous Shales and Sandstones. The rivers flow through a landscape dominated by intensive agriculture, mostly of improved grassland but also cereals. Much of the river channels were subject to arterial drainage schemes in the past. Natural flood-plains now exist along only limited stretches of river, though often there is a fringe of reed swamp, freshwater marsh, wet grassland or deciduous wet woodland. Along some parts, notably between Drogheda and Slane, are stands of tall, mature mixed woodland. Substantial areas of	There is a potential link between the proposed development at Platin and this SAC, specifically the alkaline fen and alluvial forest habitat Qualifying Interests for which the site is designated, via contaminated water, and/or changes to air quality via emissions to air, during both the construction and operational phases of the development.

European Site	Reasons for designation (information correct as of July 2017) (*denotes a priority habitat)	Source-Pathway-Receptor
	improved grassland and arable land are included in site for water quality reasons. There are many medium to large sized towns adjacent to but not within this SAC. The main channel of the Boyne contains a good example of alluvial woodland type which has developed on three alluvium islands. Alkaline fen vegetation is well represented at Lough Shesk, where there is a very fine example of habitat succession from open water to raised bog. The Boyne and its tributaries is one of Ireland's premier game fisheries and offers a wide range of angling, from fishing for spring salmon and grilse to sea trout fishing and extensive brown trout fishing. The site is one of the most important in eastern Ireland for salmon (*Salmo salar*) and has very extensive spawning grounds. The site also has an important population of river lamprey (*Lampetra fluviatilis*), though the distribution or abundance of this species is not well known. Otter (*Lutra lutra*) is widespread throughout the site. Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of whooper swan (*Cygnus Cygnus*). Several Red Data Book plants occur within the site, with round-leaved wintergreen (*Pyrola rotundifolia*), a bluegrass (*Poa palustris*) and compressed rush (*Juncus compressus*). Also occurring are a number of Red Data Book animals, notably badger (*Meles meles*), pine marten (*Martes martes*) and common frog (*Rana temporaria*). The River Boyne is a designated Salmonid Water under the EU Freshwater Fish Directive.	
Boyne Coast and Estuary SAC (001957)	•Estuaries [1130] •Mudflats and sandflats not covered by seawater at low tide [1140] •Salicornia and other annuals colonizing mud and sand [1310] •Spartina swards (Spartinion maritimae) [1320] •Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] •Mediterranean salt meadows (*Juncetalia maritimi*) [1410] •Embryonic shifting dunes [2110] •Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] •*Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Site Specific Conservation Objectives: 31/10/12	There is a potential link between the proposed development at Platin and this SAC, specifically the habitat Qualifying Interests for which the site is designated, via contaminated water, and/or changes to air quality via emissions to air, during both the construction and operational phases of the development.

European Site	Reasons for designation (information correct as of July 2017) (*denotes a priority habitat)	Source-Pathway-Receptor
	According to the site's Natura 2000 information form, this moderately sized coastal site, which is situated below the town of Drogheda, comprises most of the estuary of the Boyne River, a substantial river which drains a large catchment. On the seaward side this SAC extends north and south for several kilometres to include the remaining intact areas of dune systems at Baltray and Mornington, as well as the adjacent beaches and intertidal sand flats. The main channel of the Boyne is contained by training walls for navigable purposes. As well as intertidal sand and mud flats, the inner part of the site has salt marshes and Spartina swards. While the site has a good diversity of coastal habitats, including fixed dunes, most have been modified in some way. The containment of the main tidal channel has altered the tidal pattern which affects the functioning of the various estuarine habitats. Both dune systems were formerly far more extensive but much of the stable areas have now been converted to golf courses. This SAC is important for wintering waterfowl, supporting nine species in nationally important numbers, including golden plover (*Pluvialis apricaria*), an Annex I EU Birds Directive species. Little tern (*Sterna albifrons*) breeds or attempts to breed in most years.	
Special Protection Areas		
Boyne Estuary SPA (004080)	•[wintering] Shelduck *Tadorna tadorna* •[wintering] Oystercatcher *Haematopus ostralegus* •[wintering] Grey Plover *Pluvialis squatarola* •[wintering] Golden Plover *Pluvialis apricaria* •[wintering] Lapwing *Vanellus vanellus* •[wintering] Knot *Calidris canutus* •[wintering] Sanderling *Calidris alba* •[wintering] Black-tailed Godwit *Limosa limosa* •[wintering] Redshank *Tringa totanus* •[wintering] Turnstone *Arenaria interpres* •[breeding] Little Tern *Sterna albifrons* •Wetlands & Waterbirds Site Specific Conservation Objectives: 26/02/13 According to the site's Natura 2000 form, this moderately-sized coastal site, which is situated below the town of Drogheda, comprises most of the estuary of the Boyne River, a substantial river which drains a large catchment. Apart from one section which is over 1 km wide, the width is mostly less than 500 m. The main river channel, which is navigable and dredged, is defined by training walls, the	There is a potential link between the proposed development at Platin and this SPA, specifically the overwintering birds and the wetland habitat Special Conservation Interests for which the site is designated, via contaminated water, and/or changes to air quality via emissions to air, during both the construction and operational phases of the development.

European Site	Reasons for designation (information correct as of July 2017) (*denotes a priority habitat)	Source-Pathway-Receptor
	latter being breached in places. Intertidal flats occur on the sides of the channelled river. The sediments vary from fine muds in the innermost areas to sandy muds or sands towards the mouth. The linear stretches of intertidal flats to the north and south of the river mouth are mainly sands. Intertidal areas are fringed by salt marshes in the inner sheltered areas. Spartina is frequent on the flats and salt marshes. The Boyne Estuary is one of the most important sites for wintering waterfowl on the east coast. It has a total of 10 species with populations of national importance – of particular note is that it supports 7.0% of the national total of knot (*Calidris canutus*) and 4.0% of the total for golden plover (*Pluvialis apricaria*). Other species which have populations of national importance include shelduck (*Tadorna tadorna*), oystercatcher (*Haematopus ostralegus*), lapwing (*Vanellus vanellus*), black-tailed godwit (*Limosa limosa*), redshank (*Tringa totanus*) and turnstone (*Arenaria interpres)*. The site provides both feeding and roosting areas for the birds. Little tern (*Sterna albifrons*) bred in the past but successful breeding has not occurred since 1996.	
River Boyne and River Blackwater SPA (004232)	•Kingfisher *Alcedo atthis* Generic Conservation Objectives: 15/08/16 According to the site's Natura 2000 form, the River Boyne and River Blackwater SPA is a long linear site that comprises stretches of the River Boyne and several of its tributaries: most of the site is in Co Meath but it extends also into Counties Cavan, Louth and Westmeath. It includes the following river sections: The River Boyne from the M1 motorway bridge, west of Drogheda, to the junction with the Royal Canal, west of Longwood, Co Meath; the River Blackwater from its junction with the River Boyne in Navan to the junction with Lough Ramor in Co Cavan; the Tremblestown River (and Athboy River) from the junction with the River Boyne at Kilnagross Bridge to the bridge in Athboy, Co Meath; the Stoneyford River from its junction with the River Boyne to Stonestone Bridge in Co. Westmeath; the River Deel from its junction with the River Boyne to Cummer Bridge, Co.Westmeath. The site includes the river channel and marginal vegetation The River Boyne and River Blackwater SPA supports nationally important numbers of kingfisher (*Alcedo atthis*). Other species which occur within the site include mute swan (*Cygnus olor*), teal (*Anas crecca*), mallard (*Anas platyrhynchos*), cormorant (*Phalacrocorax carbo*), grey	There is a potential link between the proposed development at Platin and this SPA, specifically the kingfisher Special Conservation Interest, via contaminated water, and/or changes to air quality via emissions to air, during both the construction and operational phases of the development.

European Site	Reasons for designation (information correct as of July 2017) (*denotes a priority habitat)	Source-Pathway-Receptor
	heron (*Ardea cinerea*), moorhen (*Gallinula chloropus*), snipe (*Gallinago gallinago*) and sand martin (*Riparia riparia*).	
River Nanny Estuary and Shore SPA (004158)	•[wintering] Oystercatcher *Haematopus ostralegus* •[wintering] Ringed plover *Charadrius hiaticula* •[wintering] Golden plover *Pluvialis apricaria* •[wintering] Knot *Calidris canutus* •[wintering] Sanderling *Calidris alba* •[wintering] Herring gull *Larus argentatus* •Wetlands & Waterbirds Site Specific Conservation Objectives: 21/09/12 According to the site's Natura 2000 form, the site comprises the estuary of the River Nanny and sections of the shoreline to the north and south of the estuary (c.3 km in length). The estuarine channel, which extends inland for almost 2 km, is narrow and well sheltered. Sediments are muddy in character and edged by saltmarsh and freshwater marsh/wet grassland. The shoreline, which is approximately 500 m in width to the low tide mark, comprises beach and intertidal habitats. It is a well-exposed shore, with coarse sand sediments. The well-developed beaches, which are backed in places by clay cliffs, provide high tide roosts for the birds. The village of Laytown occurs in the northern side of the River Nanny estuary. This is an important east coast site, with nationally important populations of golden plover (*Pluvialis apricaria*), oystercatcher (*Haematopus ostralegus*), ringed plover (*Charadrius hiaticula*), knot (*Calidris canutus*), sanderling (*Calidris alba*) and herring gull (*Larus argentatus*). The population of knot (*Calidris canutus*) and sanderling (*Calidris alba*) are of particular note as they represent 4% and 3.8% of the respective all-Ireland totals. A range of other waterfowl species also occur, including light-bellied brent goose (*Branta bernicla hrota*), as well as *Larus* (gulls.). The site is of most importance as a roost area for the birds but also provides feeding habitat.	There is a potential link between the proposed development at Platin and this SPA, specifically the overwintering birds and the wetland habitat Special Conservation Interests for which the site is designated, via contaminated water, and/or changes to air quality via emissions to air, during both the construction and operational phases of the development.

3.3.1 Other European sites

No other European sites are considered to be relevant to this assessment of the proposed development at Platin. It is not necessary to consider any sites further in this report.

3.3.2 Other designated conservation sites (other than European sites)

Eleven proposed Natural Heritage Areas (pNHAs) occur within 10km of Platin Cement Works. The majority are concurrent with the European site designations along the Boyne and the Boyne and Nanny Estuaries. Three proposed Natural Heritage Areas, not designated at European sites, are located southwest of Platin Cement Works. These are Duleek Commons (001578), Thomastown Bog (001593) and Balrath Woodlands (001579). One further pNHA site, Cromwell's Bush Fen (001576) is located some 7km south of the site.

No impacts are expected to arise at any non-European designated site, such as the pNHAs within 5km of the Platin Facility. This is due to the distance between the sites and Platin, and the reasons for which the sites are designated. For example, no changes to groundwater levels at Duleek Comnmons pNHA are considered remotely likely as a result of the proposed development.

3.3.3 Other issues

While no invasive plant species (*i.e.* those species listed on Schedule 3 of the *Birds and Habitats Regulations, 2011*) were identified on site, there is a risk that during construction such species could be introduced to the site. Avoidance of such risk will be managed during the construction period and no such species will be planted or deliberately imported to the site.

4 Appraisal of Potential Impacts on European Sites

4.1 Introduction

The Screening exercise undertaken determined that a Natura Impact Statement is required, for the following reasons:

- Potential construction effects on European sites:
  - Potential release of contaminated surface water may pose a temporary risk to watercourses, resulting in potential effects on the Special Conservation Interests of the River Nanny Estuary and Shore SPA, located approximately 8km downstream of the River Nanny outfall (emission point SW-4);
  - Potential effects resulting from emissions to air may pose a temporary risk to the Qualifying Interests and Special Conservation Interests of the following European sites:
    - River Boyne and River Blackwater SAC;
    - Boyne Coast and Estuary SAC;
    - Boyne Estuary SPA;
    - River Boyne and River Blackwater SPA;
      River Nanny Estuary and Shore SPA.

- Potential operational effects on European sites:
  - Potential release of contaminated surface water may pose a risk to watercourses, specifically resulting in potential effects on the Special Conservation Interests of the River Nanny Estuary and Shore SPA, located approximately 8km downstream of the River Nanny outfall (emission point SW-4);
  - Potential effects resulting from emissions to air may pose a risk to the Qualifying Interests and Special Conservation Interests of the following European sites:
    - River Boyne and River Blackwater SAC;
    - Boyne Coast and Estuary SAC;
    - Boyne Estuary SPA;
    - River Boyne and River Blackwater SPA;
    - River Nanny Estuary and Shore SPA.

This Natura Impact Statement therefore examines these potential impacts on the integrity of the European sites, in the context of the Conservation Objectives of the European sites.

4.2 Conservation objectives, threats and vulnerabilities of the European sites

A key aim of the Habitats Directive is to '*maintain or restore the favourable conservation status of habitats and species of community interest*'. Site-specific conservation objectives aim to define favourable conservation condition for particular habitats or species within a European site. In the case of European sites for which site-specific conservation objectives have not yet been prepared, generic conservation objectives have been provided by NPWS.

Generic conservation objectives for the **River Boyne and River Blackwater SAC** were published on 15th August 2016. The conservation objectives are:

- To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.

Site-specific conservation objectives for the **Boyne Coast and Estuary SAC** were published on 31st October 2012. The conservation objectives are:

- To maintain the favourable conservation condition of Estuaries, Mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) in the Boyne Coast and Estuary SAC;
- To restore the favourable conservation condition of *Salicornia* and other annuals colonising mud and sand, Embryonic shifting dunes, Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') and *Fixed coastal dunes with herbaceous vegetation ('grey dunes') in the Boyne Coast and Estuary SAC.

Site-specific conservation objectives for the **Boyne Estuary SPA** were published on 26th February 2013. The conservation objectives are:

- To maintain the favourable conservation condition of each of the bird species and the wetland habitat in Boyne Estuary SPA listed as Special Conservation Interests for this SPA.

Generic conservation objectives for the **River Boyne and River Blackwater SPA** were published on 15th August 2016. The conservation objectives are:

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

Site-specific conservation objectives for the **River Nanny Estuary and Shore SPA** were published on 21st September 2012. The conservation objectives are:

- To maintain the favourable conservation condition of each of the bird species and the wetland habitat in River Nanny Estuary and Shore SPA listed as Special Conservation Interests for this SPA.

4.3 Appraisal of likely effects on European Sites

4.3.1 Potential effects on European sites during construction

4.3.1.1 Habitats and species

The proposed development will involve the construction of structures associated with the storage and conveying of the proposed alternative fuels and raw materials. No **designated sites or habitats of any ecological value** will be affected by this construction work.

4.3.1.2 Contaminated surface water

All construction activities will be carried out within the catchment area of the site drainage system. All surface water from the site passes through balancing and settlement tanks and these are effective in removing suspended solids. In addition, oil interceptors and absorbent booms in the existing surface water treatment system are effective in removing any accidental spills of oils or other hydrocarbons.

However, surface construction activities pose a potential risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off. Surface water run-off from surface construction activities has the potential to become contaminated. The main potential contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on-site toilet and washing facilities; and
- Concrete/ cementitious products: arising from construction materials.

These pollutants could pose a temporary risk to surface water quality for the duration of construction if not properly contained and managed. Suspended solids, which can include silt, affect surface water turbidity and are considered to be the greatest risk to surface water quality from construction activities. Suspended Solids can also reduce light penetration, visually impact the receiving water, and damage the ecosystem. Potential activities that could generate suspended solids include:

- Water removal from surface excavations as a result of rainfall or groundwater seepage;
- Runoff from exposed work areas and excavated material storage areas ;and
- Washdown areas: The potential for washdown containing cement to increase the pH of water above a neutral range, that is typically pH 6 to 9, could pose a threat to aquatic species living in a watercourse.

Potential activities that could generate other pollutants listed above include:

- Inappropriate handling and storage of construction materials and chemicals;
- Leakage of temporary foul water services; and
- Solid (municipal) wastes entering the watercourses or drainage systems.

The Contractor will be required to comply with the Construction and Environmental Management Plan (refer to Appendix 4) which will incorporate the mitigation measures detailed below. These mitigation measures apply for the prevention of pollution to all waters during construction:

- Prepare an Emergency Response Plan (refer to Appendix 3) detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or non-compliance incident. This plan will contain the following information:
    - Containment measures;
    - List of appropriate equipment and clean-up materials;

  - Maintenance schedule for equipment;
  - Details of trained staff, location, and provision for 24-hour cover;
  - Details of staff responsibilities;
  - Notification procedures to inform the relevant environmental authorities;
  - Audit and review schedule;
  - Telephone numbers of Meath County Council Drainage and Pollution Control Divisions; and
  - List of specialist pollution clean-up companies and their telephone numbers.
- Ensure site staff are trained in the implementation of the Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas/discharge to combined sewer. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities;
- The Contractor will comply with the following guidance documents:
  - CIRIA – Guideline Document C532 Control of Water Pollution from Construction Sites (CIRIA, 2001) and
  - CIRIA – Guideline Document C624 Development and Flood Risk - guidance for the construction industry (CIRIA, 2004).

There will be no significant residual effect on water and hydrology as a result of the construction phase of the proposed development due to the provision of these detailed mitigation measures. Accordingly it is concluded that there will be no significant effects on the Special Conservation Interests of the River Nanny Estuary and Shore SPA as a result of this element of the proposed development. No other European site is relevant. In consequence it can be said with scientific certainty that there will be no impact on the integrity of the River Nanny Estuary and Shore SPA in light of its conservation objectives.

4.3.1.3 Emissions to air

Potential effects on air quality and ecological receptors arising at the construction phase are not expected to be significant. The proposed construction site is considered to be at a 'minor' scale. This category of site has the potential for significant soiling effects within 25m; PM_{10} effects within 10m; and vegetation effects within 10m of the site boundary if standard mitigation measures are in place. As no sensitive receptors are located within 25m of the areas of any of the proposed construction works, no significant effects due to construction activities are envisaged. However, measures will be undertaken during the construction works to minimise dust generation. The following measures will be implemented at a minimum:

- Spraying of exposed earthwork activities and site haul roads during dry weather;
- Control of vehicle speeds on site;
- Sweeping of hard surfaces on-site and in the surrounding area, as required.

Dust deposition monitoring is required by the Platin Cement Works Industrial Emission licence on a quarterly basis. Dust deposition monitoring will be carried out and compared to the limit of 350mg/m2/day (averaged over a 30-day period) to ensure the effectiveness of the measures outlined above.

There will be no significant residual effects on air quality as a result of the construction phase of the proposed development due to the provision of these detailed mitigation measures. Accordingly it is concluded that there will be no significant effects on the Qualifying Interests or Special Conservation Interests of the five European sites under appraisal in this report as a result of this element of the proposed development. In consequence it can be said with scientific certainty that there will be no impact on the integrity of the relevant European sites in light of their conservation objectives.

4.3.2 Potential effects on European sites during operation

4.3.2.1 Contaminated surface water

As the majority of the proposed new structures are located within or around the existing developed footprint of the works, they will only give rise to minor additional rainwater runoff from the roofs of the proposed main structures and storage areas as outlined below:

- Tanks for Pumpable Fluids for Kiln 2 and Kiln 3;
- Alternative Raw Materials building;
- 3 no. silos for fine solids supplying Kiln 2;
- 3 no. silos for fine solids supplying Kiln 3;
- 2 no. handling buildings for 'free flowing' solids for Kiln 2 and Kiln 3;
- Coarse Solids handling building for Kiln 2 and Kiln 3;
- Coarse Solid Conveying building for Kiln 2 and Kiln 3;
- Whole tyre storage area and conveying for Kiln 2.

The total additional impermeable area from these buildings will be c.1.9 ha. With an impermeable area of approx. 17.5 ha for the developed area of the full site this represents a minor increase of 10.1%. In addition, the new buildings will generally be located on ground that is currently hard-standing.

The runoff from the roofs of the new structures will be collected in a storm water drain which will be connected to the overall site surface water drainage network.

The introduction of up to an additional 480,000 tonnes per annum of Alternative Fuels and Alternative Raw Materials will also include for eight additional fire water retention tanks (one of which replaces an existing tank which is to be removed) and/or bunded facilities, as part of the proposed development. Fire Water Retention Tanks and bunded facilities are connected to the surface water drainage network. This drainage network has an open/shut valve which under normal circumstances is open to allow for the drainage of surface water. In the event of a fire, the drainage valve closes to allow for the retention of all potentially contaminated surface water. This water is then tested and approved for release, treated on-site or removed from the site for treatment, as required.

The most recent Review of Firewater Risk Assessment (prepared as per Condition 3.9.2 of the IE Licence) concludes that all bunds provided on-site are designed and constructed in line with industry best practice. Assessment of the environmental risk associated with these areas shows that the risk to the aquatic environment is low to medium. Therefore it is not considered that the risk warrants the provision of additional containment to that provided by the bunds.

The following new firewater retention tanks / bunded facilities are proposed:

1. Proposed (relocated) tank for existing Fine Solids (SRF) Kiln 3 Facility;
2. Proposed Tank associated with Coarse Solids Facility;
3. Proposed Tank associated with Alternative Raw Materials Facility;
4. Proposed Tank associated with Fine Solids Kiln 2 Facility;
5. Proposed Tank associated with Whole Tyres Facility;
6. Pumpable Fluids Tanks for K2 and K3 are located within a bunded Facility;
7. Silos for Free flowing Solids for K2 are located within a bunded Facility;
8. Silos for Free flowing Solids for K3 are located within a bunded Facility.

The purpose of these tanks / bunded facilities is to ensure that, in the unlikely event of a fire, potentially contaminated firewater is isolated and retained from the general surface water drainage network within these tanks until it is tested, approved for release, treated on-site or removed from the site for treatment, as required.

There is no additional water required to cater for the increased use of alternative fuels and the use of alternative raw materials on site. There are no additional domestic effluent or treated process discharges due to the proposed development.

The study by Ecofact Environmental Consultants in 2016 (Ecological and Sediment Study of the River Nanny - refer to Appendix 5) showed no evidence that the discharge from the Irish Cement Limited Platin facility is having any significant impact on the biological water quality of the downstream areas surveyed. There will be no changes to the nature (either quantity or quality) of water abstracted, processed or discharged to the River Nanny as a result of the proposed development and no other impacts on water are expected. Platin Cement Works will be required to continue to comply with surface water emission limit values for emission point SW-4 specified in Industrial Emission Licence (Reg. No. P0030-04).

There will be no significant residual effect on water and hydrology as a result of the operational phase of the proposed development due to the provision of these detailed mitigation measures. Accordingly it is concluded that there will be no significant effects on the Special Conservation Interests of the River Nanny Estuary and Shore SPA as a result of this element of the proposed development. No other European site is relevant. In consequence it can be said with scientific certainty that there will be no impact on the integrity of the relevant European sites in light of their conservation objections.

4.3.2.2 Emissions to air

The use of additional alternative fuels and alternative raw materials will result in a number of positive indirect effects on air quality and climate, for example:

- Reduced use of natural raw materials;
- Reduced energy requirement for blasting and crushing.

An assessment of the potential direct effects is considered below. The maximum predicted ground-level concentrations (GLCs) are presented in Table 3 (extracted from Chapter 8 of the EIA Report) for the existing and the proposed scenarios. The percentage change in pollutant concentrations is calculated relative to the air quality standards.

Definitions are outlined below for the terms used in Table 3;

- Environment - the baseline pollutant concentrations;
- PC (existing) - the process contribution from Platin Cement Works, as determined by the existing emission data;
- PC (proposed) - the process contribution from Platin Cement Works, as determined by the proposed emission data;
- Predicted increase relative to AQS - the percentage difference between PC existing + environment and PC proposed + environment, as a percentage of the Air Quality Standards.

As can be seen in Table 3, the predicted concentrations comply with the AQS in the case of each potential pollutant.

Table 3 Predicted ground level concentrations for the existing and proposed scenarios

Parameter	Air Quality Standard (AQS) (µg/m³)	Environment (µg/m³)	PC (existing) (µg/m³)	PC (proposed) (µg/m³)	PC (existing) + Environment (µg/m³)	PC (proposed) + Environment (µg/m³)	PC (proposed) + Environment relative to AQS/limit (%)	Predicted increase relative to AQS/limit (%)
PM_{10}	40 (Annual)	18.3	2.82	2.9	21.12	21.2	53.0%	0.2
	50 (24-hour) (90.41st percentile)	18.3	8.04	8.1	26.34	26.4	52.8%	0.1
$PM_{2.5}$	25 (Annual)	11.2	2.0	2.0	13.2	13.2	51.9%	0.0
Nitrogen Dioxide	40 (Annual)	5.8	1.52	1.47	7.32	7.31	18.3%	0.0
	200 (99.79 percentile)	11.6[1]	24.45	26.4	36.06	36.07	18.0%	0.0
Nitrogen Oxides	30 (Annual)	9.5	5.26	5.31	14.76	14.81	49.4%	0.2
Sulphur Dioxide	20 (Annual)	2.9	0.53	0.53	3.43	3.43	17.2%	0.0
	125 (24-hour) (99.18th percentile)	2.9	3.51	3.6	6.41	6.5	5.2%	0.1
	350 (1-hour) (99.73rd percentile)	5.8[1]	8.2	8.2	14.01	14.01	4.0%	0.0
Hydrogen Chloride	20 (Annual)	-	0.11	0.106	0.11	0.106	<1%	0.0
	750 (1-hour)	-	2.12	2.13	2.12	2.13	<1%	0.0
Hydrogen Fluoride	1 (Annual)	-	0.01	0.01	0.01	0.01	1.0%	0.0
	160 (1-hour)	-	0.202	0.213	0.202	0.213	<1%	0.0
Cadmium	0.005 (Annual)	0.0003	0.00011	0.00012	0.00041	0.00042	8.4%	0.2
	1.5 (1-hour)	0.0006[1]	0.00235	0.0024	0.00296	0.00301	<1%	0.0
Thallium	1 (Annual)	-	0.00047	0.00049	0.00047	0.00049	<1%	0.0
	30 (1-hour)	-	0.0094	0.009	0.0094	0.0094	<1%	0.0
Mercury	1 (Annual)	0.0014	0.0005	0.0005	0.0019	0.0019	<1%	0.0
Antimony	5 (Annual)	-	0.00001	0.00001	0.00001	0.00001	<1%	0.0
	150 (1-hour)	-	0.0002	0.00024	0.0002	0.00024	<1%	0.0
Arsenic	0.006 (Annual)	0.0016	0.00004	0.00004	0.00164	0.00164	27.3%	0.0
	15 (1-hour)	0.0032[1]	0.0008	0.00087	0.00401	0.00407	<1%	0.0
Lead	0.5 (Annual)	0.0022	0.00017	0.00013	0.00237	0.00233	<1%	0.0
Chromium	5 (Annual)	-	0.00327	0.003	0.00327	0.00333	<1%	0.0
	150 (1 hour)	-	0.0638	0.0675	0.0638	0.0675	<1%	0.0

Parameter	Air Quality Standard (AQS) (µg/m³)	Environment (µg/m³)	PC (existing) (µg/m³)	PC (proposed) (µg/m³)	PC (existing) + Environment (µg/m³)	PC (proposed) + Environment (µg/m³)	PC (proposed) + Environment relative to AQS/limit (%)	Predicted increase relative to AQS/limit (%)
Cobalt	0.2 (Annual)	-	0.00001	0.00002	0.00001	0.00002	<1%	0.0
Copper	10 (Annual)	-	0.00023	0.00025	0.00023	0.0002	<1%	0.0
	200 (dust and mist)	-	0.0045	0.0047	0.0045	0.0052	<1%	0.0
Manganese	0.15 (Annual)	-	0.00084	0.00086	0.00084	0.00086	<1%	0.0
	1,500 (1-hour)	-	0.0164	0.017	0.0164	0.017	<1%	0.0
Nickel	0.02 (Annual)	0.0013	0.00051	0.0005	0.00181	0.0018	9.0%	-0.1
	300 (1 hour)	0.0026[1]	0.01	0.01	0.01261	0.01301	<1%	0.0
Vanadium	5 (Annual)	-	0.00012	0.00012	0.00012	0.00012	<1%	0.0
	1 (24-hour)	-	0.00091	0.00091	0.00091	0.00091	<1%	0.0
	1 (1-hour)	-	0.0024	0.0024	0.0024	0.0024	<1%	0.0
Dioxins	0.0000003 (Annual)	-	1.00E-09	1.00E-09	1.00E-09	1.00E-09	<1%	0.0
Carbon Monoxide	10,000 (8-hr average)	267	61.1	87.67	328.1	354.67	<1%	0.0
Ammonia	2,500 (1-hour)	-	10.25	10.25	10.25	10.25	<1%	0.4
	180 (Annual)	-	0.24	0.25	0.24	0.24	<1%	0.1

It is noted that there are no habitats within the Zone of Influence of the proposed development, that is, habitats that may be impacted by the proposed development, regardless of distance from the site, such as active raised bog habitats in SACs, which may be sensitive to nitrogen deposition. Regardless, an assessment of nitrogen deposition at all nearby ecological sensitive areas has been carried out. The highest predicted annual average concentration of NO_2 is 0.64 µg/m^3 and is predicted to occur at the River Boyne and River Blackwater River SAC.

Assuming a deposition velocity of 0.001 m/s the nitrogen deposition at the River Boyne and River Blackwater River SAC (3km to the north of the Platin facility) is calculated based on the following:

- 1 µg/m^3 NO_2 = 0.1 kg N ha^{-1} yr^{-1}

This results in a total value of 0.06 kg N ha^{-1} yr^{-1}. This is significantly lower than the UNECE critical load for nitrogen of 5-10 Kg N ha^{-1} yr^{-1} for inland and surface water habitats. These habitats include all of the habitats that are classified as Qualifying Interests for the SACs, as follows:

- River Boyne and River Blackwater SAC:
  - Alkaline fens [7230]
  - *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno padion, Alnion incanae*, *Salicion albae*) [91E0]

- Boyne Coast and Estuary SAC:
  - Estuaries [1130]
  - Mudflats and sandflats not covered by seawater at low tide [1140]
  - Salicornia and other annuals colonizing mud and sand [1310]
  - Spartina swards (*Spartinion maritimae*) [1320]
  - Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
  - Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
  - Embryonic shifting dunes [2110]
  - Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]
  - *Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]

The species listed as Qualifying Interests in the River Boyne and River Blackwater SAC (Atlantic salmon, river lamprey and otter) are not considered to be in any way sensitive to changes in nitrogen deposition levels.

In addition, the Special Conservation Interests in the SPAs within the Zone of Influence of the proposed development that is, habitats or species that may be impacted by the proposed development, regardless of distance from the site (overwintering birds and wetland habitats in the case of the River Nanny Estuary and Shore SPA and the Boyne Estuary SPA, and kingfisher in the case of the River Boyne and River Blackwater SPA) are not considered to be in any way sensitive to changes in nitrogen deposition levels.

Taking this into account, it can reasonably be concluded that, in the case of the Qualifying Interests (in the case of the SACs) and Special Conservation Interests (in the case of the SPAs) for the European sites under appraisal, there will be no significant effects as a result of the proposed development.

The air quality modelling work undertaken predicts that all air quality standards and guidelines, including the existing and future revised IE Licence, for the facility, will be complied with; therefore no mitigation measures are proposed as part of this development.

There will be no significant residual effects on air quality as a result of the operational phase of the proposed development. Accordingly it is concluded that there will be no significant effects on the Qualifying Interests or Special Conservation Interests of the five European Sites under appraisal in this report as a result of operational emissions to air of the proposed development. In consequence it can be said with scientific certainty that there will be no impact on the integrity of the relevant European Sites in light of their conservation objectives.

4.4 Appraisal of likely significant effects on European sites and in-combination effects

It is a requirement of the *Birds and Natural Habitats Regulations*, 2011 that when considering whether a plan or project will adversely affect the integrity of a European site the assessment must take into account in-combination effects with other current or reasonably foreseeable plans and projects.

- If it can be clearly demonstrated that the plan or project will not result in any impact on the integrity of a European site then the plan or project should proceed without considering the in-combination test; further,
- If there are identified effects arising from the plan or project even if they are perceived as minor and not likely to have a an impact on the integrity of a European site alone, then any such impacts must be considered 'in-combination' with the effects arising from other plans and projects.

Indaver Ireland operates a Waste-to-Energy facility at Carranstown which is approximately 800m from Platin Cement Works. The cumulative effect of this facility was assessed by considering the ambient air quality and the source contributions due to Platin and Indaver. Information on emissions were obtained from the Indaver Carranstown Environmental Impact Statement, 2012 as part of the application to increase the capacity of the plant.

As per the EPA's Air Guidance, Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) the impact area for the cumulative assessment is defined by the USEPA as a circular area with a radius extending from the source to the most distant point where dispersion modelling predicts a 'significant' ambient effect (5% of the AQS for criteria pollutants).

The guidance document suggests that a single limit of 100 tonnes/annum of any regulated pollutant from the existing installation be used as the threshold level for assessment. For each pollutant above that threshold, a limit of 25% of the AQS is recommended to be used for assessing effects from the nearby installation, above which detailed modelling is required for assessing the cumulative effect.

Based on 2016 mass emission data, the only pollutant at ICL Platin that exceeds 100 tonnes/annum is NO_x.

The maximum ground level concentrations predicted for Platin Cement Works and for Indaver were assumed to be coincident, that is, to occur at the same location and at the same time. This is highly conservative and would rarely if ever be realised in practice.

In Table 4, extracted from Chapter 8 of the EIA Report, ground level concentrations from Indaver and PC (proposed), i.e. Platin Cement Works contribution + Indaver, including background levels (environment), are compared to Air Quality Standards.

Table 4 Cumulative Concentrations Compared to Air Quality Standards

Parameter	AQS ($\mu g/m^3$)	25% of AQS ($\mu g/m^3$)	Indaver contribution ($\mu g/m^3$)	Indaver contribution % of AQS ($\mu g/m^3$)	PC (proposed) + Environment + Indaver ($\mu g/m^3$)	PC (proposed) + Environment + Indaver relative to AQS (%)
NO_2 (annual)	40	10	0.85	2.1%	8.16	20.4%
NO_2 (1-hour)	200	50	27.19	13.6%	63.26	31.6%
NO_x (annual)	30	7.5	1.13	3.8%	15.93	53.1%

As outlined in Table 4, the Indaver facility does not contribute to more than 25% of the AQS for the three parameters presented. Therefore, no detailed modelling for the cumulative effect of the Indaver and Platin Cement Works facilities is required, in accordance with EPA guidance. Accordingly, it can be said with scientific certainty that there will be no impact from in-combination or cumulative effects on the integrity of the relevant European Sites in light

of their conservation objectives.No other potential cumulative effects on ecological receptors are expected to arise as a result of the proposed development for example effects on designated sites, habitats, species or water quality.

4.5 Mitigation measures

All construction works will comply with legislative requirements, best practice and the requirements of IE Licence P0030-04. A Construction and Environmental Management Plan (refer to Appendix 4) has been prepared and all works will comply with the requirements of this document. Other measures, including the full implementation of the Firewater Risk Assessment requirements (refer to Appendix 2) and the Emergency Response Procedures (refer to Appendix 3) will ensure no significant effects arise on any ecological receptors as a result of the proposed development.

Specifically in relation to the relevant European sites, there will be no impacts on their integrity in light of their conservation objectives as a result of the proposed development. No mitigation measures are required apart from those associated with air and water emission control and the IE Licence in general, as presented in Chapters 7 and 8 of the EIA Report and reproduced in Section 4.3.1 and 4.3.2 of this document.

5 Summary and conclusions

This Natura Impact Statement has considered the potential impacts of a proposal by ICL for development for further replacement of fossil fuel with alternative fuels and for the use alternative raw materials in Platin Cement Works, near Duleek, County Meath on the integrity of the relevant European sites.

This report concludes on the best scientific evidence that it can be clearly demonstrated that no elements of the project will result in any impact on the integrity or Qualifying Interests/Special Conservation Interests of any relevant European site, either on their own or in-combination with other plans or projects, in light of their conservation objectives

It is considered that this NIS provides sufficient relevant information to allow the Competent Authority (An Bord Pleanála) to carry out an AA Screening, and if necessary an Appropriate Assessment, and reach a determination that the proposed development will not affect the integrity of any of the relevant European sites under Article 6 of the Habitats Directive (92/43/EEC) in light of their conservation objectives.

6 References

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NPWS (2013b). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland

Online data available on European sites as held by the National Parks and Wildlife Service (NPWS) (www.npws.ie/protectedsites)

Planning and Development, Act 2000, as amended

Appendices

Appendix 1 – Background to Appropriate Assessment

The European[1] network is a Europe-wide network of ecologically important sites (SPAs and cSACs – also known as 'European Sites' or 'Natura 2000 sites') that have been designated for protection under either the EU Birds Directive (Council Directive 79/409/EEC on the Conservation of Wild Birds) or the EU Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna).

The main aim of the Habitats Directive is *"to contribute towards ensuring biodiversity through the conservation of natural habitats of wild fauna and flora in the European territory of the Member States to which the treaty applies".* Any actions taken must be designed to *"maintain or restore, at a favourable conservation status, natural habitats and species of wild fauna and flora of Community interest".* Under Article 6 of the Habitats Directive, an assessment is required where a plan or project may give rise to significant effects upon a European site.

In addition, it is a matter of law that candidate SACs (cSACs) and Sites of Community Importance (SCI) are considered in this process;

Article 6 (paragraphs (3) and (4)) of the Habitats Directive states that:

> (3) Any plan or project not directly connected with or necessary to the management of the site but likely to have significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.
>
> (4) If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of European is protected. It shall inform the Commission of the compensatory measures adopted.''

The requirements of the Habitats Directive are transposed into Irish law by means of the *European Communities (Birds and Natural Habitats) Regulations 2011* (hereafter referred to as the *Birds and Habitats Regulations*)[2] and by the *Planning and Development Act 2000*, as amended.

In Ireland, the statutory agency responsible for the designated areas is NPWS.

[1] The EU Habitats Directive, Article 3.1, states "A Coherent European ecological network of Special Areas of Conservation and Special Protection Areas pursuant to Directive 79/409/EEC shall be set up under the title European"
[2] SI No. 477 of 2011

Stages in the assessment

European Commission guidance (2001)[3] sets out the principles on how to undertake decision making in applying the Habitats Directive. The requirements of the Habitats Directive comprise four distinct stages:

Stage 1: Screening is the process which initially identifies the likely significant effects upon a European site of a project or plan, either alone or in combination with other projects or plans. It is important to note that the burden of evidence is to show, on the basis of objective information, that there will be no significant effect; if the effect may be significant, or is not known, that would trigger the need for an Appropriate Assessment. There is European Court of Justice case law to the effect that unless the likelihood of a significant effect can be ruled out on the basis of objective information, then an Appropriate Assessment must be made.

Stage 2: Appropriate Assessment is the detailed consideration of the impact on the integrity of the European site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's conservation objectives and its structure and function. This is to determine with scientific certainty whether or not there will be adverse effects on the integrity of the site in light of its conservation objectives. This stage also includes the development of mitigation measures to avoid or reduce any possible impacts.

Stage 3: Assessment of alternative solutions is the process which examines alternative ways of achieving the objectives of the project or plan that would avoid impacts on the integrity of the European site, should avoidance or mitigation measures be unable to cancel out adverse effects.

Stage 4: Assessment where no alternative solutions exist and where adverse impacts remain. At Stage 4 an assessment is made with regard to whether or not the development is necessary for imperative reasons of overriding public interest (IROPI) and, if so, of the compensatory measures needed to maintain the overall coherence of the European network.

Conservation objectives of European sites

The conservation objectives for a European Site are intended to represent the aims of the Habitats and Birds Directives in relation to that site. To this end, habitats and species of European Community importance should be maintained or restored to 'favourable conservation status' (FCS), as defined in Article 1 of the Habitats Directive below:

The conservation status of a natural habitat will be taken as 'favourable' when:

- Its natural range and the area it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future;
- Conservation status of typical species is favourable as defined in Article 1(i).

The conservation status of a species will be taken as favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future;

[3] European Commission (2001) *Assessment of Plans and Projects Significantly Affecting European Sites: Methodological Guidance on the Provisions of Article 6 (3) and (4) of the Habitats Directive 92/43/EEC*

- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Guidance from the European Commission[4] indicates that the Habitats Directive intends FCS to be applied at the level of an individual site, as well as to habitats and species across their European range. Therefore, in order to properly express the aims of the Habitats Directive for an individual site, the conservation objectives for a site are essentially to maintain (or restore) the habitats and species of the site at (or to) FCS.

The European Commission guidance recommends that screening should fulfil the following steps:

1. Determine whether the plan (or policy) is directly connected with or necessary for the management of European sites;
2. Describe the plan and describe and characterise any other plans or projects which, in combination, have the potential for having significant effects on European sites;
3. Identify the potential effects on European sites;
4. Assess the likely significance of any effects on European sites.

[4] Managing European sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC. (European Commission 2000)

Appendix 2 – Firewater Report

Irish Cement Limited

IPPC Licence Reg. No. P0030-04

Review of Firewater Risk Assessment – Platin Cement Works

Issue F | 7 June 2017

Job number 325374-47

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Contents

Appendices

Appendix A

Environmental Risk Assessment – Platin Cement Works

1 Executive Summary

A risk assessment has been carried out of potentially contaminated firewater arising from fires at Platin Cement Works, Co Meath. The risk assessment followed the methodology set out in the EPA's Draft Guidance Note to Industry on Requirements for the Establishment of Fire-Water Retention Facilities.

The following materials stored on-site were assessed with regard to potential impact on surface waters and groundwater in the event of a fire on-site: diesel oil, pet coke, aqueous ammonia, grinding aid, alternative fuels (Fine Solids, Coarse Solids, Free-flowing Solids, Pumpable Fluids and Whole Tyres), and Alternative Raw Materials.

The quantity of diesel oil/central heating oil stored on site exceeds the threshold quantity specified by the EPA for materials to which the risk phrase R52 has been assigned. Therefore, the site requires the provision of firewater retention facilities.

The environmental risk is assessed subjectively taking into account the following factors: fire load, or quantity of combustible materials, fire risk and environmental load.

Diesel oil, grinding aid, aqueous ammonia, Performax 3400 (polyacrylic acid and sulphuric acid) and Biosperse 3001 (hypochlorite solution) are stored in double-skin tanks or single skin tanks within concrete bunds. These materials are not flammable and contaminated firewater is unlikely to arise.

Firewater retention sumps have been or will be provided for containment of the firewater and coincident rain water at the Fine Solids, Coarse Solids and Whole Tyre storage and handling areas. Irish Cement Policy will be to allow fires in the Pumpable Fluids storage facility to burn out, but cooling water may be used to protect adjacent plant and equipment.

All surface water arising from buildings and hard standing on the site is piped to the water collection system which delivers process and storm water into storm balancing tanks followed by sedimentation/settlement tanks, both of which are used to reduce the levels of suspended solids.

2 Introduction

Irish Cement Limited (ICL) operates a cement manufacturing facility at Platin, Co Meath.

A fire water risk assessment was carried out for Platin Cement Works as required by Condition 3.9.2 of the Industrial Emissions (IE) Licence Register No P0030-04.

The previous fire water risk assessment report dated 20th March 2014, has been revised to take account of the proposed development required for receiving, storage and introduction of the proposed increased range and quantity of alternative fuels (AF) and the use of alternative Raw Materials (ARM).

3 Scope

This report is based on a survey of the site, a review of the plans and documents provided by ICL and discussions with ICL staff.

The report lists the areas within the factory where runoff from a fire could potentially pose an environmental hazard (refer to Appendix A: Environmental Risk Assessment). It describes the materials used, the firefighting facilities, and the drainage systems. The total quantity of fire-water likely to be applied in the event of a fire is calculated in accordance with the methodology described in the EPA (Draft) Guidance Note to Industry on the Requirements for Fire-Water Retention Facilities [1]. The flow patterns and destination of fire-water runoff are described. The impact of rainfall is evaluated in accordance with the EPA Guidance Note.

The environmental risk is assessed, taking into account fire load, fire risk and environmental load.

The information required under Appendix B Part 11 of the EPA Guidance Note is provided in the Platin Cement Works Emergency Response Procedure.

4 Irish Cement Limited Platin Cement Works Facilities

The site layout is shown in Figure 1 including the locations of all existing and proposed storage and storage facilities, including:

- bunded and double skinned tanks,
- storage facilities for alternative fuels and
- firewater retention tanks and sumps

The unit processes at the Platin Works can be summarised as follows:

- Limestone crushing and transport to store
- Shale crushing and transport to store
- Raw milling
- Raw meal homogenising and storage
- Coal milling
- Clinker manufacture in kilns
- Cement milling
- Cement packaging
- Bulk dispatch.

In addition, facilities are provided for storage of materials, including:

- Pet coke
- Alternative fuel
- Aqueous ammonia
- Grinding aid

Platin Cement Works already has permission for the use of up to 120,000 tonnes per annum of alternative fuels. Irish Cement Ltd is now applying to An Bord Pleanála for a 10-year planning permission for development to provide for on-site receiving, storage and introduction of up to an additional 480,000 tonnes per annum of alternative fuels and alternative raw materials.

To facilitate this increased use of alternative fuels, a number of additional structures and associated equipment are proposed for Platin. The broad categories of reception, temporary storage and handling systems can be subdivided based on the typical physical characteristics of the various waste materials;

- Fine Solids, e.g. solid recovered fuel (SRF), chipped timber, shredded plastics, shredded textiles, tyre fluff
- Coarse Solids, e.g. Shredded tyre chips, shredded wood, dry filter cakes, shredded rubber
- Pumpable Fluids, e.g. secondary liquid fuels SLF, solvents, waste oils, paint sludge, liquid animal fat
- Free-flowing Solids, e.g. Meat and bone meal, sewage sludge pellets, fine plastic pellets
- Whole Tyres
- Alternative Raw Materials, e.g. Alum filter cake, soils and stones, dusts.

The proposed development, which also includes for a proposed increase in the volumetric gas flow, will require a review of its existing Industrial Emissions (IE) Directive Licence (Register No P0030-04).

5 Materials

The following materials stored on-site were assessed with regard to potential impact on surface waters and groundwater in the event of a fire on-site:

- Diesel oil
- Pet coke
- Aqueous ammonia
- Grinding aid
- Alternative Fuels and Alternative Raw Materials

The EPA Draft Guidance Note gives threshold quantities for substances classified under specified risk phrase numbers. Of the materials listed above, only diesel oil has an EPA-specified risk phrase number, R52/53. None of the alternative fuels or alternative raw materials has been allocated any of the risk phrases R50, R51, R52 or R53.

The EPA Guidance Note states that industrial operations will generally require fire-water retention facilities where the quantities of dangerous materials exceed these threshold quantities. The threshold quantities are given in Table 1.

Table 1: Dangerous Substance Storage and Threshold Quantities

	Risk Phrase			
Risk Phrase No.	**R50**	**R51**	**R52**	**R53**
Material Quantity (approximate maximum storage capacity)	**Very toxic to aquatic organisms**	**Toxic to aquatic organisms**	**Harmful to aquatic organisms;**	**May cause long-term adverse effects in the aquatic environment**
Threshold Value (tonnes)	1	10	100	1000
Quantity of Diesel & Central heating Oil on site (R52/53) (tonnes)	-	-	500	500

From Table 1 it is evident that, for the risk phrase number R52, the inventory of materials on-site is in excess of the EPA indicative threshold quantity.

Table 2 describes the storage location and type of containment provided for materials that could potentially pollute the aquatic environment in the event of loss of containment or fire (refer also to Figure 1).

Concrete bund integrity testing is carried out periodically on concrete bunds in accordance with requirements of the IPPC Licence. All concrete bunds were found to be watertight in the assessments reported to the Agency in the 2012, 2013 and 2014 Annual Environmental Reports (AERs).

Table 2 Site Bund Schedule

Ref.	Substance	Status	Maximum Tank Capacity (L)	Tank Location	Tank Material	Containment
1	Taxed diesel	Existing	113,500	Opposite garage	Steel	Concrete bund
2	Quarry untaxed diesel	Existing	113,500	Top of quarry	Steel	Concrete bund
3	Production untaxed diesel	Existing	114,300	North of Raw Mill 1 building	Steel	Concrete bund
4	Diesel tanks	Existing	59,010	Under old Kiln 2 platform	Steel	Concrete bund
5	CEM I Grinding aid tanks	Existing	2 x 30,000 (60,000)	Above old Kiln 2 platform	Orthophthalic GRP	Concrete bund
6	CEM II Grinding aid tanks	Existing	2x 30,000 (60,000)	Adjacent to grate cooler DB room	Orthophthalic GRP	Concrete bund
7	Central heating oil	Existing	2 x 6,500 (13,000)	New Engineering Building	Steel	Double skinned tank
8	Central heating oil	Existing	3,000	Garage	Plastic	Double skinned tank
9	Furnace diesel oil	Existing	4,550	Raw Mill Building	Steel	Single skinned tank on bunded pallet
10	Emergency generator diesel oil	Existing	1,500	Kiln 2	Steel	Single skinned tank on bunded pallet
11	Central heating oil	Existing	3,500	Production Building	Steel	Double skinned tank
12	Ammonia water (<25%)	Existing	2 x 120,000 (240,000)	North of Raw Mill 1 building	Stainless steel	Concrete bund
13	Production untaxed diesel	Existing	2,300	Packing Plant	Steel	Double skinned
14	Crusher diesel oil	Existing	3,000	Right of Crusher	Plastic	Double skinned
15	Emergency generator diesel oil	Existing	4,000	Kiln 3	Steel	Concrete bund
16	Kiln burner diesel tank	Existing	20,000	Kiln 3	Steel	Concrete bund
17	Performax 3400 (polyacrylic acid and sulphuric acid)	Existing	300	Beside Blue Tank	Plastic	Single skinned tank in plastic bund
18	Biosperse 3001 (hypochlorite solution)	Existing	300	Beside Blue Tank	Plastic	Single skinned tank on bunded pallet
19	Performax 3400 (polyacrylic acid and sulphuric acid)	Existing	500	Next to CM4 cooling tower	Plastic	Single skinned tank on bunded pallet
20	Biosperse 3001 (hypochlorite solution)	Existing	2 x 300 (600)	Next to CM4 cooling tower	Plastic	Single skinned tank on bunded pallet

Ref.	Substance	Status	Maximum Tank Capacity (L)	Tank Location	Tank Material	Containment
21	Solid Recovered Fuel	Part Existing and part Proposed	5 bunkers – capacity 1,000 m³ (300 tonnes) each	South and east of Limestone Stores	Concrete	203m³ concrete bund above ground
22	Fire-water Retention tank	Existing to be replaced by larger tank	No tank – Bund only	Beside fine solids building for Kiln 3	Concrete	Existing concrete bund 200m³. Replacement concrete bund 400m³
23	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Coarse solids handling building for Kilns 2 and 3	Concrete	Concrete bund 325 m³
24	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Fine Solids Handling Building for Kiln 2	Concrete	Concrete bund 200m³
25	Pumpable fluids tanks for Kiln 2 and 3	Proposed	2 no. 20,000, 1 no. 7000	Pumpable fluids silos for Kiln 2 and 3	Steel	Concrete bund 840m³
26	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Beside Alternative Raw Materials Facility	Concrete	Concrete bund 325m³
27	Fire-water Retention tank (proposed)	Proposed	No tank – Bund only	Whole Tyres Facility	Concrete	Concrete bund TBDm³
28	Free flowing Solids	Proposed		Silos for Free flowing Solids for Kiln 2	Concrete	Concrete bund 464m3
29	Free flowing Solids	Proposed		Silos for Free flowing Solids for Kiln 3	Concrete	Concrete bund 464m3

6 Fire Protection

ICL has emergency response procedures in place which outline the actions required and the people responsible for dealing with the following situations: fire, explosion and spill of flammable or environmentally harmful material. All employees are informed in the procedures including evacuation routes, alarm systems, reporting to supervisors and personal protective equipment.

Fire protection of the Platin Works consists of:

- Fire prevention;
- Fire containment;
- Fire detection;
- Fire suppression.

6.1 Fire Prevention

Fire prevention is achieved by:

- Minimising risk of loss of containment of flammable materials;
- Minimising risk of ignition of flammable or combustible materials;
- Training of staff.

The proposed storage tanks for pumpable fluids will be provided with inert gas blanketing to prevent the formation of potentially explosive atmospheres.

6.2 Fire Containment

Platin Cement Works is laid out as a series of discrete storage and production units. This layout is a major factor in limiting the potential for fire spread from one unit to another. In addition, the principal raw materials, intermediates and products of the cement manufacturing process are non-combustible.

Spill containment is achieved through bunding of tanks or use of a double skinned tank in the case of the central heating oil tank. Storage tanks are generally located away from potential sources of ignition.

All bunds referred to in Table 2 are designed in line with industry best practice. However, such bunds are not designed to retain large volumes of fire-water. The fire-water in excess of the bund capacity would enter the storm water drainage and treatment system, where there is potential to retain firewater in the balancing tanks.

6.3 Fire Detection

Automatic fire detection is provided in the electrical substation and in all office buildings.

Fire detection associated with existing and proposed storage of combustible materials including alternative fuels is as follows:

Table 3: Fire Detection

Material	Location	Fire Detection
Fine pet coke	Storage bin and bag filter hopper	Carbon monoxide (CO) detection
Fine Solids (e.g. SRF)	Shed/Unloading	Heat detectors Flame detectors CCTV
	Supply to Pre-calciner	Heat detector Flame detector
Coarse solids	Storage building	CCTV
Free-flowing solids	Store (silos)	CCTV
Whole tyres	Storage and handling area	CCTV
Pumpable fluids	Tanks and bund	CCTV
Alternative Raw Materials	Storage building	CCTV

6.4 Fire Suppression

Firefighting facilities comprise:

- A set of firefighting and emergency rescue equipment is located at the Central Fire Point under Kiln 1 drive station.
- Firefighting water hydrants and fireboxes are located as shown on the site risk map in the Platin Cement Works Emergency Response Procedure.
- Portable fire extinguishers are located at points around the Works shown on the site risk map.
- Foam concentrate is stored on site for use by the Fire Brigade which is equipped with a foam generation unit that would be brought on site in the event of a fire at the SRF storage area. Sufficient concentrate is stored for generation of foam for suppressing a 40 minute fire. The concentrate is intended for use at 1-3% dilution).
- Platin Cement Works has six spill response kits at locations close to the areas where chemicals/flammables are stored in larger quantities. The spill kit locations are:
  - At the main entrance to the cement milling building,
  - At the diesel/fuel oil tanks at the firing end of Kiln 2,
  - The untaxed diesel storage tank opposite the garage,
  - The diesel storage tank at the quarry entrance,
  - At the garage,
  - In the stores.

  Each spill kit contains a variety of absorbent materials.

Fire suppression facilities for proposed storage of alternative fuels and alternative raw materials will comprise hose reels, sprinklers and portable fire extinguishers as required for the fire risk presented in each storage unit.

7 Site Drainage

Management of process and storm water runoff on-site consists of a water collection system which delivers process and storm water into storm balancing tanks followed by sedimentation/settlement tanks, both of which are used to reduce the levels of suspended solids (refer to Figure 2).

Deep well water from the quarry is managed through continuous pumping of groundwater from the deep well in the quarry floor. It does not require any treatment.

Domestic effluent is treated in a purpose built package wastewater treatment plant on-site.

Treated process and storm water runoff discharges from the sedimentation tank and confluences with deep well water from the quarry and treated domestic effluent to form the final treated effluent which discharges to the outfall point into the River Nanny via a designated pipeline.

Table 5 shows the retention capacities of the various tanks at the site. The storm balancing tanks alone have a capacity of 1,365m³, which is more than 10 times the worst case volume of diesel oil that would be released.

Table 4: Surface water treatment system capacity

Parameter	Value	Units
Storm Balancing Tank (8 chambers)	1,365	m³
Sedimentation tanks	690	m³
Total retention capacity	2,055	m³
Average through-flow	2,000	m³/day
Average retention time	1.03	days

The treated final effluent is discharged through an underground 610mm diameter pipeline, 2637m long, which runs from the Cement Works to the outfall to the receiving waters of the River Nanny.

8 Firewater and Rainwater

8.1 Rainwater

The effect of rainwater is normally taken into account in fire-water containment studies. It is credible that in the event of a major fire on-site, there could also be a period of heavy rain, although this is extremely unlikely.

Rain falling on the Works buildings, plant equipment and hard standing areas drains through downpipes into the storm water system, which was described in section 6. This rainwater would normally be expected to be uncontaminated.

Rainfall data from the Meteorological Office show the following:

Table 5: Rainfall

Mean annual precipitation	931.6 mm (1)
4-hour precipitation event 20-year return	33.5 mm (2)
24-hour precipitation event 20-year return	60.7 mm (2)

(1) Met Éireann's website 30-year metrological data; http://www.met.ie/climate/mullingar.asp

(2) Met Éireann; Extreme Rainfall Return Period data

The EPA (Draft) Guidance Note recommends that fire-water runoff during a fire be based on the 24-hour event with a return period of 20 years, or 50 mm, whichever is greater. Rainfall data provided by Met Éireann shows that the 24-hour rainfall event for a 20 year return period for Easting: 306490 Northing: 271801 is 60.7 mm. As the maximum 24-hour figure, 20-year return is greater, it will be used to calculate the fire-water retention volume required.

Where the environmental risk assessment (refer to Appendix A) shows a high environmental risk, it is proposed to provide dedicated fire-water retention facilities for the area in question, such that rainwater falling on the area could be isolated from the site storm water drainage system. Therefore, the rainwater contribution to the volume of fire-water to be retained in the event of a fire in one of these areas is calculated based on the footprint of the area in question.

8.2 Fire Suppression Water

Water used to suppress a fire on-site would consist of ICL firefighting water and water brought on-site by Meath/Drogheda Fire Brigade.

Based on discussions with Meath Fire Brigade, in the event of a large fire, the fire brigade would be expected to bring two fire tenders on-site, each with a capacity of 11 m^3. This water would be used very quickly in the event of a large fire. Water used to fight the fire would predominantly come from the site fire hydrants which are supplied by:

- The internal borehole supply from the quarry, which is pumped to the 'Blue' ground level tank (capacity = 2,000 m³) and thence re-pumped to the Break Pressure/Header tanks on top of the Raw Meal Silo (capacity = 280 m³)
- Supply from the Cruicerath reservoir (capacity = 2,270 m³) which draws from the Drogheda Corporation supply and which supplies the site via a 3.5 km long 300 mm dia. delivery main to the main site entrance

The internal water supply is utilised for process water with the Cruicerath supply used as a standby.

The adequacy of the firefighting water supply and runoff containment was assessed in a report in 1993 [6]. This report concluded that the internal water supply is capable of providing a 5 m³/min flow for at least 9 hours. This is in line with Meath County Council requirements. The fire main is regularly tested by Abacus Fire & Safety Limited and achieves 4 bar at all hydrants tested.

The volumes of potentially contaminated fire-water that could be generated in the event of a fire in different areas of the Works are presented in Attachment A.

9 Environmental Risk Assessment

The environmental risk is assessed subjectively taking into account the following factors:

- Fire load, or quantity of combustible materials
- Fire risk
- Environmental load.

The environmental risk assessment methodology is described in Appendix A, Environmental Risk Assessment, section A.1.

9.1 Site Environmental Risk Assessment Areas

The environmental risk assessments of those areas of the site that could pose a risk to the aquatic environment are described in Appendix A, Environmental Risk Assessment, section A.2. The areas assessed in Appendix A.2 were selected based on the nature and quantities of the materials stored. The nature of these materials is discussed below.

9.1.1 Diesel Oil

Diesel oil is categorised by risk phrase R52/53, i.e. it is harmful to aquatic organisms and may cause long term adverse effects in the aquatic environment. Due to its high flash point (56ºC minimum), ignition of diesel oil is extremely unlikely.

9.1.2 Aqueous Ammonia

Aqueous ammonia with a concentration of less than 25% w/w ammonia is stored on-site in steel tanks. The tanks are located within retention bunds with a capacity of 110% of the largest tank. This material will be used for reducing emissions of nitrogen oxides to atmosphere in the kiln gases.

Ammonia solutions with a concentration of less than 25% are classified as “Corrosive” and carry the risk phrase R34.

The ammonia is stored in a stainless steel, single-sheathed tank. The tank is enclosed by a concrete bund, which is designed to retain up to 110% of the capacity of the tank. Therefore, in the event of total loss of containment, the bund will have sufficient capacity to retain the entire contents of the tank.

9.1.3 Grinding Aid

Grinding aid is a liquid mixture of a number of materials, of which only two are classified as hazardous:

Table 6: Grinding Aids

Material	CAS No	Risk phrases
2.5-10% triethanolamine	102-71-6)	R36/38 (Irritating to eyes and skin)
10-25% ethylene glycol	107-21-1	R22 (Harmful if swallowed)

9.1.4 Pet Coke

Petroleum coke (often referred to as Pet coke or petcoke) is a carbonaceous solid that is generated by oil refinery coker units or other cracking processes. It is a solid, composed of carbon and other high molecular weight and water insoluble materials. Some metals are present but usually at very low concentrations. The concentrations of these metals are quite variable depending upon the source of the coke.

Although there is no direct evidence on the leachability of components from petroleum coke, a study has been conducted on the leachability and ecotoxicity of coal gasifier solid waste, a similar material to petroleum coke. Extraction of this material in the form of bottom ash was accomplished with either distilled water or using the US EPA EP toxicity extraction procedure. The concentrations of metals in the extract were all at levels considered "non-hazardous" by US EPA (RCRA) standards.

It is concluded that a fire involving pet coke would not result in contamination of the receiving waters, i.e. River Nanny.

9.1.5 Fine Solids (Existing and Proposed)

Fine Solids are currently stored in a purpose built building on site for use in Kiln 3. It is proposed to extend the floor area of this building by 490m². Fine Solids for use in Kiln 2 will be stored at the northern end of the site in a new building with floor area approximately 1,242m².

While no data has been found to show Fine Solids runoff to be harmful the aquatic environment, it is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff as follows:

- An existing retention tank for the Fine Solids (SRF) building at Kiln 3, with capacity of 200m³will be replaced with a new tank of 400m³ at a new location a short distance to the west of its existing location. This is to facilitate the proposed extension of the existing building.
- A new retention tank with capacity 200m³ will be provided adjacent to the Fine Solids building for Kiln 2.

9.1.6 Coarse Solids (Proposed)

Coarse Solids will be stored in a building with a floor area of approximately 4,875 m². While no data has been found to show Coarse Solids runoff to be harmful the aquatic environment, it is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff as follows:

A retention tank with capacity 325m³ will be provided.

9.1.6.1 Free-Flowing Solids Silos (Proposed)

Two Free-Flowing Solids silos will be provided for Kiln 2 and two for Kiln 3. Each pair of silos will be protected against fire by CO detection and inert gas system and enclosed within a concrete bund wall. Therefore, fire-water would not be generated in the case of a fire in any of these silos. However, hose reels for cooling of adjacent tank, plant and equipment in the event of a fire in adjacent facilities.

9.1.6.2 Pumpable Fluids Storage (Proposed)

The Pumpable Fluids blend used at Irish Cement will not be classified as dangerous to the environment. The policy with regard to fires in the solvent tank or bund will be to allow such fires to burn out, while using a water drenching system to cool adjacent tanks and hose streams to cool adjacent buildings. Portable powder fire extinguishers will be provided for suppressing small fires.

Hence contaminated firewater is not expected to arise from this facility.

An underground retention sump (capacity 25 m³) will be provided for containing any spills that might arise during road tanker discharge.

The storage tanks will be located within a concrete bund with a capacity of approximately 840m³.

9.1.6.3 Alternative Raw Materials (Proposed)

Alternative Raw Materials will be stored in a building with a floor area of approximately 2,853 m². These materials are non-combustible and insoluble in water. However, it is considered appropriate to provide a retention tank with capacity 325m³.

9.1.6.4 Whole Tyres (Proposed)

Whole tyres will be stored within a contained area at the northern end of the site. Tyres will be loaded on to a conveyor for feeding to Kiln 2. The area used for storage will be 835 m² and the area within which the tyre handling equipment will be located is approximately 287m². It is considered appropriate to retain fire-water in order to protect surface and groundwater from any potentially harmful runoff. In order to contain firewater run-off and coincident rain runoff a retention tank with capacity 200m³ will be provided.

10 Fire-Water Retention

In the event of small fires firewater would be contained in sumps local to the fire location as follows:

- Under the Fine Solids storage bays – fire water is pumped using a float switch to the Fine Solids fire water bund.
- Under the TULS (Fine Solids loading system) – fire water is pumped using a float switch to the Fine Solids fire water bund.
- Delivery yard – all firewater collects at a sump. A manual valve is closed to the plant storm water tanks and the fire water that has collected is pumped to the Fine Solids fire water bund.

It is proposed to provide in-line firewater retention tanks at the locations shown in Table 8.

Table 7: Firewater Retention tanks

Ref[1]	Material	Unit	Existing/Proposed	Description	Capacity (m^3)
21/22	Fine Solids (SRF)	Kiln 3	Existing – to be replaced	Tank for Fine Solids (SRF) Kiln 3 Facility	400
23	Coarse Solids		Proposed	Tank associated with Coarse Solids Facility	325
26	Alternative Raw Materials		Proposed	Tank associated with Alternative Raw Materials Facility	325
24	Fine Solids	Kiln 2	Proposed	Tank associated with Fine Solids Kiln 2 Facility	200
27	Whole Tyres		Proposed	Tank associated with Whole Tyres Facility	200
25	Pumpable Fluids		Proposed	Pumpable Fluids Tanks for K2 and K3 are located within a bunded Facility	300
28	Free Flowing Solids	Kiln 2	Proposed	Silos for Free flowing Solids for K2 are located within a bunded Facility	NA
29	Free Flowing Solids	Kiln 3	Proposed	Silos for Free flowing Solids for K3 are located within a bunded Facility	NA
Note 1: Reference in Figure 1					

In the event of a large fire, some of the firewater runoff could reach the surface water drainage system. However, all will be retained onsite in the storm balancing tanks and the sedimentation tanks.

Table 9 shows the retention capacities of the various tanks at the site. The storm balancing tanks alone have a capacity of 1,365m³, which is more than 10 times the worst case volume of diesel oil that would be released.

Table 8: Surface water treatment system capacity

Parameter	Value	Units
Storm Balancing Tank (8 chambers)	1,365	m³
Sedimentation tanks	690	m³
Total retention capacity	2,055	m³
Average throughflow	2,000	m³/day
Retention Time	1.03	days

Any fire-water retained on-site would be disposed of by a method agreed with the Agency. The proposed disposal methods include:

- Disposal off-site by a licensed contractor
- Reuse in the plant as process water
- Pumping to the site storm water drainage system subject to analysis of the water showing it was safe to do so.

11 Conclusions

The quantities of fire-water and coincident rainwater have been calculated for those areas of the Cement Works where the nature and quantities of materials stored pose a risk to the aquatic environment in the event of fire. The volumes of contaminated fire-water that could potentially be generated during a fire on-site have been calculated in accordance with the methodology specified by the EPA.

All bunds provided on-site are designed and constructed in line with industry best practice. Assessment of the environmental risk associated with these areas shows that the risk to the aquatic environment is low to medium. Therefore, it is not considered that the risk warrants the provision of additional containment to that provided by the bunds.

Fire-water containment is provided for the existing alternative fuels unloading and storage facilities by the storage facilities themselves and the existing firewater retention sump. Additional firewater retention tanks and/or bunded facilities will be provided for the proposed alternative fuel and alternative raw materials storage and handling facilities.

References

[1] Environmental Protection Agency (1995) Draft Guidance Note to Industry on Requirements for the Establishment of Fire-Water Retention Facilities

[2] CONCAWE (1993) Petroleum coke product dossier no. 93/105

[3] Environmental Protection Agency (2004) IPPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities

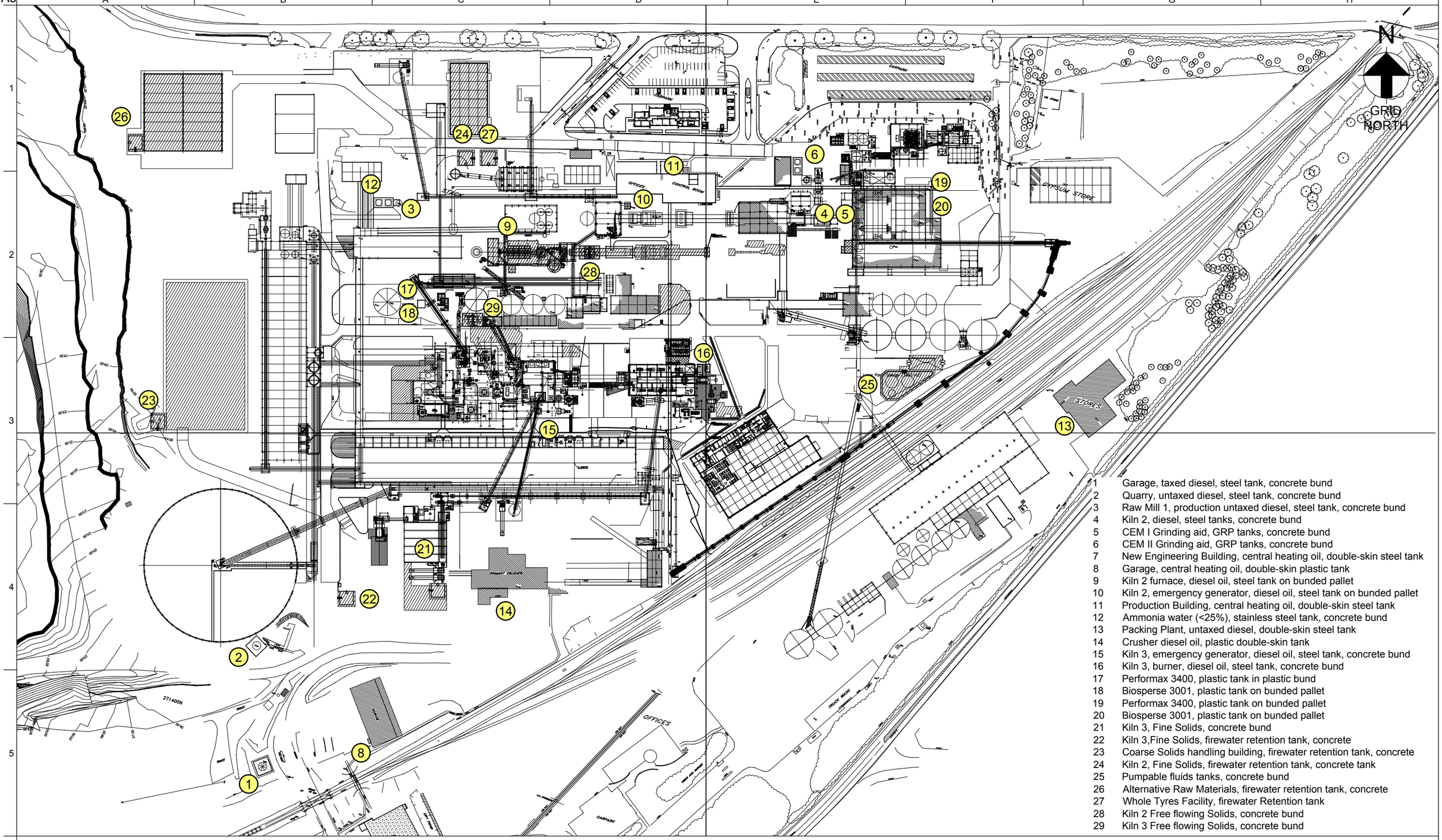
[4] CIRIA (1997) Report 163 Construction of bunds for oil storage tanks

[5] CIRIA (2003) C598 Chemical storage tank systems – good practice

[6] E.G. Pettit & Co. (1993), Report *Irish Cement Ltd. Platin Works Firefighting Water Supply*

Figures

Figure 1 Location of Bunds and Double Skin Tanks



1 Garage, taxed diesel, steel tank, concrete bund
2 Quarry, untaxed diesel, steel tank, concrete bund
3 Raw Mill 1, production untaxed diesel, steel tank, concrete bund
4 Kiln 2, diesel, steel tanks, concrete bund
5 CEM I Grinding aid, GRP tanks, concrete bund
6 CEM II Grinding aid, GRP tanks, concrete bund
7 New Engineering Building, central heating oil, double-skin steel tank
8 Garage, central heating oil, double-skin plastic tank
9 Kiln 2 furnace, diesel oil, steel tank on bunded pallet
10 Kiln 2, emergency generator, diesel oil, steel tank on bunded pallet
11 Production Building, central heating oil, double-skin steel tank
12 Ammonia water (<25%), stainless steel tank, concrete bund
13 Packing Plant, untaxed diesel, double-skin steel tank
14 Crusher diesel oil, plastic double-skin tank
15 Kiln 3, emergency generator, diesel oil, steel tank, concrete bund
16 Kiln 3, burner, diesel oil, steel tank, concrete bund
17 Performax 3400, plastic tank in plastic bund
18 Biosperse 3001, plastic tank on bunded pallet
19 Performax 3400, plastic tank on bunded pallet
20 Biosperse 3001, plastic tank on bunded pallet
21 Kiln 3, Fine Solids, concrete bund
22 Kiln 3,Fine Solids, firewater retention tank, concrete
23 Coarse Solids handling building, firewater retention tank, concrete
24 Kiln 2, Fine Solids, firewater retention tank, concrete tank
25 Pumpable fluids tanks, concrete bund
26 Alternative Raw Materials, firewater retention tank, concrete
27 Whole Tyres Facility, firewater Retention tank
28 Kiln 2 Free flowing Solids, concrete bund
29 Kiln 3 Free flowing Solids, concrete bund

Issue	Date	By	Chkd	Appd
R1	22/05/17	GMcT	DM	DM

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Job Title
Review of IE Licence
Reg. No. P0030-04

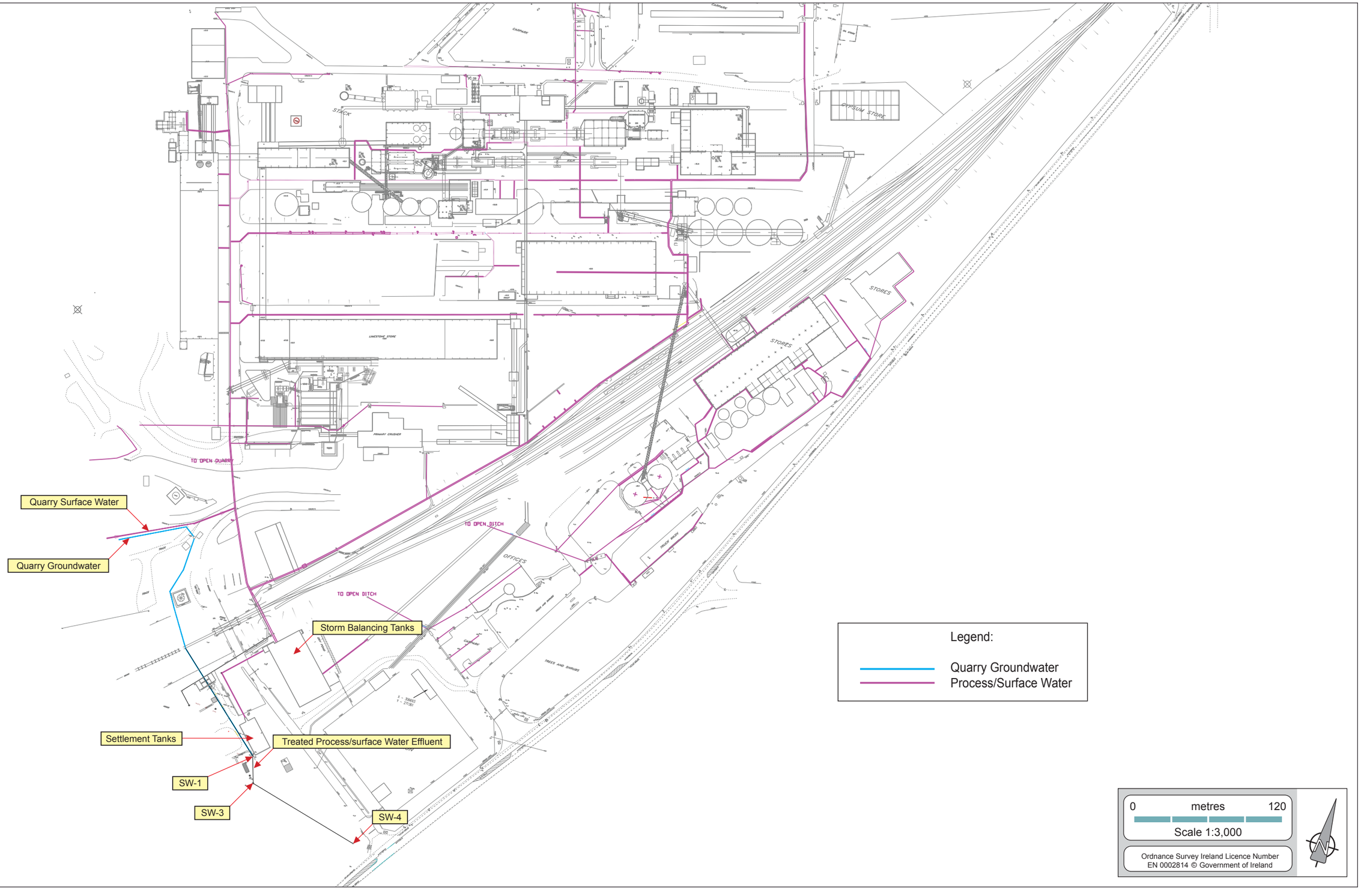
Client
Irish Cement Ltd

Drawing Title
Figure 1
Location of Bunds and Double Skinned Tanks

Scale at A3 1:2500
Discipline Consulting
Job No **325374-47**
Drawing Status **Report**
Drawing No **N2012**
Issue **R1**

Do not scale

Figure 2 Process/Storm Water Conveyance, Treatment Plant and Emission Points



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Process/Surface Water and Groundwater Conveyance, Treatment Plant and Emission Points

Irish Cement Ltd IPPC Licence Reg. No. P0030-04

D5374.41 | March 2014 | Figure 2

Appendix A

Environmental Risk Assessment – Platin Cement Works

A1 Risk Assessment Methodology

Environmental risk includes the risk and extent of fire, the environmental load and the area at risk. The area at risk includes:

- The extent of the water polluted.
- Any uses to which the receiving waters are put (potable water, livestock water, crop irrigation, fishing, amenity use, wild life habitat).

The environmental risk is assessed subjectively taking into account the following factors:

- Fire load, or quantity of combustible materials
- Fire risk
- Environmental load.

A1.1 Fire Load

The fire load is a function of the quantities of combustible materials present and the likely rate of combustion. The following broad classification of fire load is used:

Fire Load	Description	Fire Load Factor
Low	Aqueous solutions, metal items (machinery, storage racking) or glass.	1
Medium	Significant quantities of packing materials, stationery etc.	2
High	Substantial quantities of combustible materials, or large quantities of flammable liquids.	3

A1.2 Fire Likelihood

The likelihood of fire depends on the following factors:

- Likelihood of ignition
- Likelihood of non-detection
- Likelihood of failure to extinguish promptly.

The likelihood of ignition is lowest where there are no flammable or highly flammable liquids or gases, or only small quantities.

The likelihood of non-detection is highest where the relevant area is unoccupied for most of the time, and where there is no automatic fire detection or sprinkler system.

The likelihood of failure to extinguish promptly, given that the fire has been detected promptly, is low, where there are automatic sprinklers, and medium elsewhere.

Fire Likelihood	Description	Fire Likelihood Factor
Low	A fire is unlikely	1
Medium	A fire is possible	2
High	A fire is likely	3

A1.3 Environmental Load

The environmental load is an assessment of the total potential for environmental damage. The environmental load depends on the characteristics and quantities of materials which could cause environmental damage, in this case damage to the receiving waters. The characteristics include:

- BOD
- Acute toxicity effects
- Persistence of the pollutant
- Risk of bio-accumulation.

Environmental Load	Description	Environmental Load Factor
Low	Little potential for any significant damage to the receiving waters.	1
Medium	Potential for minor damage or long term effects.	2
High	Potential for major damage, and likely long term effects.	3

A1.4 Methodology For Determining Environmental Risk

The Environmental Risk Score is calculated as the product of the scores for the three above factors.

The environmental risk is judged to be high, medium or low according to the following scale:

Environmental Risk Score	Environmental Risk	Description
>12	High	Situation is hazardous in relation to the environment (receiving waters), and action is required
7-12	Medium	Discernible risk, may require remedial measures if within reasonable resource
≤6	Low	Risk not significant

A2 Risk Assessment

A2.1 Assessment of Existing Concrete Bunded Tanks

A2.1.2 Storage of Untaxed Diesel Tank at top of Quarry
A2.1.3 Storage of Untaxed Diesel North of Raw Mill 1 Building
A2.1.4 Storage of Diesel Oil under old Kiln 2 Platform
A2.1.5 Storage of CEM I Grinding Aid above old Kiln 2 Platform
A2.1.6 Storage of CEM II Grinding Aid adjacent to Grate Cooler DB Room
A2.1.7 Storage of Aqueous Ammonia north of Raw Mill 1 Building
A2.1.8 Storage of Untaxed Diesel Oil at Kiln 3

A2.1.1 Taxed Diesel Oil Tank Opposite Garage

Item	Description	
Activities	Storage of diesel oil	
Materials	Diesel oil	
Fire fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of tank or fire surface in bund.	109 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	7 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**7 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	700 m^3
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.2 Untaxed Diesel Oil Tank at Top of Quarry

Item	Description	
Activities	Storage of diesel oil	
Materials	Diesel oil	
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of tank or fire surface.	106 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	6 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**6 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. .As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.3 Untaxed Diesel Tank North of Raw Mill 1 Building

Item	Description	
Activities	Storage of diesl oil	
Materials	Diesel oil	
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of diesel oil tank or fire surface.	93 m²
Firewater		0 m³
Rainwater	Surface area of bund x rainfall	6 m³
Quantity of fire-water and rainwater runoff	**N/A**	**6 m³**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. .As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.4 Diesel Oil Tank under Old Kiln 2 Platform

Item	Description	
Activities	Storage of Diesl oil	
Materials	Diesel oil	
Fire Fighting	A fire in this area would be attended by Meath/Drogheda Fire Brigade.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	High	
Environmental Risk	**Medium**	
Area	Surface area of diesel oil tank(s) or fire surface.	92 m^2
Firewater		0 m^3
Rainwater	Surface area of bund x rainfall	6 m^3
Quantity of fire-water and rainwater runoff	**N/A**	**6 m^3**
Containment of fire-water	Fire-water would be largely retained in the bund.	
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.	

A2.1.5 CEM I Grinding Aid Tank above Old Kiln 2 Platform

Item	Description
Activities	Storage of grinding aid
Materials	CEM I grinding aid
Fire Fighting	CEM I grinding aid is non-flammable, therefore a fire in this bund is not considered credible.
Fire Load	Low
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**
Area	N/A
Rainwater	N/A
Firewater	
Quantity of fire-water and rainwater runoff	**N/A. Cooling water would be applied to the CEM I grinding aid tanks in the event of a diesel tank fire under the platform.**
Containment of fire-water	Fire-water would be largely retained in the bund.
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.

A2.1.6 CEM II Grinding Aid Tank adjacent to Grate Cooler DB Room

Item	Description
Activities	Storage of grinding aid
Materials	CEM II grinding aid
Fire Fighting	CEM II grinding aid is non-flammable, therefore a fire in this bund is not considered credible
Fire Load	Low
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**
Area	N/A
Rainwater	N/A
Firewater	
Quantity of fire-water and rainwater runoff	**N/A**
Containment of fire-water	Fire-water would be largely retained in the bund
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.

A2.1.7 Aqueous Ammonia Tanks North of Raw Mill 1 Building

Item	Description
Activities	Storage of aqueous ammonia
Materials	Ammonia water (<25%)
Fire Fighting	Ammonia water is non-flammable, therefore a fire in this bund is not considered credible.
Fire Load	Low
Fire Likelihood	Low
Environmental Load	Medium
Environmental Risk	**Low**
Area	N/A
Rainwater	N/A
Quantity of Fire-water runoff	**N/A. Cooling water would be applied to the ammonia water tanks in the event of a diesel tank fire to prevent buckling.**
Containment of fire-water	N/A
Comment	The environmental risk is low, therefore, no further fire-water containment is considered necessary. The fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund with capacity equal to the greater of 110% of the tank/25% capacity of both tanks.

A2.1.8 Untaxed Diesel Oil Tank at Kiln 3

Item	Description
Activities	Storage of diesel oil
Materials	Diesel oil
Fire Fighting	A diesel oil tank fire would be attended by Meath/Drogheda Fire Brigade
Fire Load	Low
Fire Likelihood	Medium
Environmental Load	High
Environmental Risk	**Medium**
Fire suppression water	Water would not be applied to a fire. Cooling water would be applied to the tank in the event of a tank fire to prevent buckling.
Quantity of fire-water runoff	**N/A**
Containment of fire-water	Fire-water would be largely retained in the bund
Comment	The environmental risk is medium. As the fire-water retention currently provided is consistent with industry best practice, i.e. reinforced concrete bund of capacity 110% of the tank, further fire-water retention is not considered necessary.

A2.2 Assessment of Existing Double and Single Skinned Tanks

Where it is not considered practical to provide a concrete bund for diesel oil, heating oil or other materials, either double skinned tanks with leak detection or bunded pallets are used (refer to Figure 1 and Table 2, Refs. 7, 8, 9, 10, 11, 13, 14, 17, 18).

EPA guidelines [3] list CIRIA Report 163 [4] as a recognised design standard. In relation to double-skinned tanks CIRIA Report 163 states that *'a double-skinned storage tank could be considered to be either (a) a high specification primary container (high specification in that it has two skins rather than the normal one) or (b) a combination of primary containment (the inner skin) and secondary containment (the outer skin)'.* CIRIA C598 [5] states that a double skinned tank may be used where there are physical or practical limitations to the size of a bund that may be constructed.

The environmental risk associated with these areas is assessed as follows:

Fire Load	High
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**

As the environmental risk is low, no additional fire-water containment is proposed.

A2.3 Assessment of Existing Petroleum Coke Stockpile

A2.3 Petroleum Coke Stockpile

Item	Description
Activities	Storage of Pet Coke
Materials	Petroleum coke
Fire Fighting	A large fire in this area would be fought by Meath/Drogheda Fire Brigade
Fire Load	High
Fire Likelihood	Low
Environmental Load	Low
Environmental Risk	**Low**
Area	Fire surface area
Rainwater	See below
Quantity of fire-water runoff	**The total quantity of fire-water would comprise the water applied to the fire by the fire brigade and the coincident rainwater. The fire brigade would apply water from tenders, but would rely on the ICL water supply for a large fire. A large fire could require application of water for several hours. Rainwater from this area would not be separated from rainwater falling elsewhere on the site.**
Containment of fire-water	Some fire-water would be absorbed by the pet coke. Fire-water would also enter the storm water drainage system
Comment	The environmental risk is low, therefore, fire-water containment is not considered necessary

A2.4 Assessment of Existing and Proposed Facilities for Storage and Handling of Alternative Fuels and Alternative Raw Materials

A2.4.1 Storage of Fine Solids for Kiln 3
A2.4.2 Existing and Proposed Fine Solids Unloading Area at Kiln 3
A2.4.3 Storage of Fine Solids for Kiln 2
A2.4.4 Fine Solids Introduction and Metering Building for Kiln 2
A2.4.5 Coarse Solids Storage and Handling Building for Kiln 2 and Kiln 3
A2.4.6 Coarse Solids Conveying Building for Kiln 3
A2.4.7 Pumpable Fluids Storage
A2.4.8 Pumpable Fluids Unloading
A2.4.9 Whole Tyre Storage and Handling
A2.4.10 Alternative Raw Materials Storage
A2.4.11 Free-Flowing Solids

A2.4.1 Storage of Fine Solids for Kiln 3

Item	Description	
Activities	Storage of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m²
Fire suppression water	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m³
Rainwater		8 m³
Quantity of fire-water and rainwater runoff		**106 m³**
Containment of fire-water	Gross volume of Drag Chain void	759 m³
	SRF shed divided into 5 bunkers volume 1,000 m³ each. % void space = (1- bulk density/particle density) x 100 = (1 – 300 kg/m³/1,000 kg/m³) x 100	70%
	Gross vol of cellar under bunkers approx. =	531 m³
	Sump - replaces existing sump	400 m³
Comment	Fire-water would flow to the cellar under the bunkers.	
	Rainwater contribution to fire-water is calculated assuming collapse of the roof over the bunker and a concurrent 24 hour event for a 20 year return	
	The bays are separated by fire resisting walls. 280 m³ water is available to manufacture foam. It is conservatively assumed that all foam would be used in the event of a fire in the bunker.	

A2.4.2 Existing and Proposed Fine Solids Unloading Area at Kiln 3

Item	Description	
Activities	Unloading of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m^2
	A fire covering the surface area (1,000 m^2) of one bunker in the shed is assumed.	
Fire suppression water	2 No. fire tenders @ 11 m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m^3
Rainwater		8 m^3
Quantity of fire-water runoff		**106 m^3**
Containment of fire-water	Sump - replaces existing sump	400 m^3
	This area is designed for vehicle access and as such is not suitable for fire-	
	Firewater would drain into the Drag Chain Void and cellar under the	

A2.4.3 Storage of Fine Solids for Kiln 2

Item	Description	
Activities	Storage of Fine Solids	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	High	
Environmental Risk	**High**	
Area	A fire is assumed to occur in one bunker only.	131 m²
Fire suppression water	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m³
Rainwater		8 m³
Quantity of fire-water and rainwater runoff		**106 m³**
Containment of fire-water	In-line Firewater Retention tank	200 m³
	Gross volume of Drag Chain void	759 m³
	SRF shed divided into 5 bunkers volume 1,000 m³ each. % void space = (1- bulk density/particle density) x 100 = (1 – 300 kg/m³/1,000 kg/m³) x 100	70%
	Gross vol of cellar under bunkers approx. =	531 m³
Comment	Fire-water would flow to the cellar under the bunkers.	
	Rainwater contribution to fire-water is calculated assuming collapse of the roof over the bunker and a concurrent 24 hour event for a 20 year return	
	The bays are separated by fire resisting walls.	
	280 m³ water is available to manufacture foam. It is conservatively assumed that all foam would be used in the event of a fire in the bunker.	

A2.4.4 Fine Solids Introduction and Metering Building for Kiln 2

Item	Description	
Activities	Fine Solids metering and feed	
Materials	Fine Solids	
Fire Fighting	Hose reels, foam solution, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	A fire is assumed to occur in one bunker only.	131 m²
	A fire covering the surface area (1,000 m²) of one bunker in the shed is assumed.	
Fire suppression water	2 No. fire tenders @ 11 m³	22 m³
	Hose reels: 2 No. @ 950 litre/min ea for 40 min	76 m³
Rainwater		8 m³
Quantity of fire-water runoff		**106 m³**
Containment of fire-water	In-line Firewater Retention tank	200 m³
~~Comment~~	This area is designed for vehicle access and as such is not suitable for fire-	
	Firewater would drain into the Drag Chain Void and cellar under the	

A2.4.5 Coarse Solids Storage and Handling Building for Kiln 2 and Kiln 3

Item	Description	
Activities	Storage and handling of Coarse Solids	
Materials	Coarse Solids	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area		4,875 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		296 m^3
Quantity of fire-water and rainwater runoff		**394 m^3**
Containment of fire-water	In-line Firewater Retention tank	400 m^3

A2.4.6 Coarse Solids Conveying Building for Kiln 3

Item	Description	
Activities	Coarse Solids Conveying	
Materials	Coarse Solids	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	Medium	
Fire Likelihood	Medium	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area		287 m^2
Fire suppression water	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		17 m^3
Quantity of fire-water and rainwater runoff		**115 m^3**
Containment of fire-water	In-line Firewater Retention tank (Where the conveying building is remote from the coarse solids building)	325 m^3

A2.4.7 Pumpable Fluids Storage

Item	Description	
Activities	Pumpable fluids (flammable liquids)	
Materials	900 tonnes Pumpable Fluids	
Fire Fighting	Inert gas suppression system. Hose reels for cooling of tank in the event of a fire in adjacent facilities.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	Unloading area 230m² + bunded area 420m²	550 m²
Coolling water for tank, etc	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m³
Rainwater		33 m³
Quantity of fire-water and rainwater runoff		**131 m³**
Containment of run-off	Bund (also sump under unloading area, 25m³)	840 m³

A2.4.8 Pumpable Fluids Unloading

Item	Description	
Activities	Discharging road tankers containing pumpable fluids	
Materials	20 tonnes Pumpable Fluids in road tanker	
Fire Fighting	Inert gas suppression system in storage tank. Hose reels for cooling of tank in the event of a fire in adjacent facilities.	
Fire Load	High	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Medium**	
Area	Unloading Area	100 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		6 m^3
Quantity of fire-water and rainwater runoff		**104 m^3**
Containment of run-off	Sump beneath unloading area	25 m^3

A2.4.9 Whole Tyre Storage and Handling

Item	Description	
Activities	Storage and handling of whole rubber tyres	
Materials	Whole rubber tyres	
Fire Fighting	Hose reels, fire brigade tenders	
Fire Load	High	
Fire Likelihood	Medium	
Environmental Load	High	
Environmental Risk	**High**	
Area	Storage 835m², Handling 287m²	1,122 m²
	2 No. fire tenders @ 11m³	22 m³
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m³
Rainwater		68 m³
Quantity of fire-water and rainwater runoff		**166 m³**
Containment of run-off	In-line Firewater Retention tank	200 m³

A2.4.10 Alternative Raw Materials Storage

Item	Description	
Activities	Storage of alternative Raw Materials	
Materials	Alternative Raw Materials - non-combustible	
Fire Fighting	None required	
Fire Load	Low	
Fire Likelihood	Low	
Environmental Load	Low	
Environmental Risk	**Low**	
Area	Storage Shed	100 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater	Unloading area (+10%) x rainfall = 100m^2 x 1.1 x 0.0607 m	6 m^3
Quantity of fire-water and rainwater runoff		**104 m^3**
Containment of run-off	In-line Firewater Retention tank	700 m^3

A2.4.11 Free-Flowing Solids

Item	Description	
Activities	Storage of Free-Flowing Solids	
Materials	Free-Flowing solids	
Fire Fighting	Each pair of silos will be protected against fire by CO detection and inert gas system and enclosed within a concrete bund wall. Hose reels for cooling of adjacent tank, plant and equipment in the event of a fire in adjacent facilities.	
Fire Load	Medium	
Fire Likelihood	Low	
Environmental Load	Medium	
Environmental Risk	**Low**	
Area	Bund area	114 m^2
	2 No. fire tenders @ 11m^3	22 m^3
	Hose reels: 2 No. @ 950 litre/min each for 40 min	76 m^3
Rainwater		7 m^3
Quantity of fire-water and rainwater runoff		**105 m^3**
Containment of run-off	Bund	200 m^3

Appendix 3 – Emergency Response Procedures

EMERGENCY RESPONSE PROCEDURES PLATIN WORKS

These procedures are intended to cover any incident or disaster which may occur in Platin Works, directly involving Irish Cement Limited personnel and facilities or involving third party company personnel and facilities on our site or having a potential for any adverse impact on the environment

Distribution and updating: The control version of this document is the electronic master copy on the ICL Platin Intranet. Any paper copies are deemed obsolete. The Environmental Manager or his nominated deputy has overall responsibility for issuing necessary amendments to the controlled intranet version

M.Butler

Environmental Engineer
01/06/2017

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Revisions to Issue No 4

Revision No.	Topic	Page No.	Date Effective	Approved by
4	**All**	**All**	**Nov 2012**	**S Breen**
5	**All**	**25**	**Sept 2013**	**S Breen**
6	**Immediate Response Action- Assembly Points Update & Insurance Company Details**	**7,8**	**June 2017**	**M. Butler**

Disaster and Post - Disaster Plan

Objective

The purpose of this plan is to identify an appropriate response to be followed in the event of a disaster occurring. Revision no 4 incorporates recently implemented changes to Platin works including Kiln 3 system, response to Ammonia spills and fire in SRF system.

Scope

This plan is intended to cover any disaster which may occur in Platin Works, directly involving Irish Cement Limited personnel and facilities or involving third party company personnel and facilities on our site or having a potential for any adverse impact on the environment. A site risk map is included in Annex 1.

For detailed safety procedures, refer to Safety Procedures Manual for Platin Works.

Stage 1 Immediate Response – During Office Hours

1A.1 Evaluate Situation

- Management/Supervisor should quickly brief themselves of the situation and decide on appropriate response.

- The Shift Supervisor on duty will control and co-ordinate the emergency response for the plant (See below for the quarry and dispatch areas). Upon the arrival of the Fire Brigade, the Senior Fire Officer will, in accordance with Section 27 of the Fire Services Act 1981, assume sole charge of all fire fighting operations. In this activity the Senior Fire Officer must receive the direct guidance and advice of the shift supervisor, especially in relation to the safety of Fire Brigade personnel.

- The quarry supervisor shall control and co-ordinate the emergency response for the quarry. Should an emergency situation arise when the quarry supervisor is off site, the shift supervisor shall hand over control of the emergency situation as soon as the quarry supervisor arrives on site.

- The dispatch supervisor shall control and co-ordinate the emergency response for the dispatch area. Should an emergency situation arise when the dispatch supervisor is off site, the shift supervisor shall hand over control of the emergency situation as soon as the dispatch supervisor arrives on site.

- The plant management will provide advice and assistance to the shift supervisor as necessary.

- The shift supervisor should refer to the safety manual or environmental manual for detailed instructions and guidelines, which are located in the Central Control Room and the company intranet.

1A.2 Notify Medical and Fire Services

These services should immediately be requested if appropriate.

Service	Telephone No.
Fire Brigade Drogheda / Navan	041-9832222 / 046-9021666
Drogheda Ambulance	041-9837601 / 999 / 112
Garda Station Drogheda/Duleek	041-9874200 / 041-9823222
Lourdes Hospital	041-9837601

A more complete list of numbers is included in Annex 2.

1A.3 Notify Third Party Companies

If the disaster involves any third party companies on site then the responsible person (s) must be notified immediately.

1A.4 Notify Civil Authorities

If the disaster requires the involvement of the Civil Authorities then they should be notified immediately.

Stage 1 Immediate Response – Outside Office Hours

1B.1 Receive Details of the Disaster

- Verify, identify and confirm location of the incident and confirm name and telephone number of caller.

- Obtain Briefing

  - WHERE did the incident occur?
  - WHAT happened? E.g. fire, explosion, chemical spill etc
  - WHO was involved?
  - Is immediate medical assistance required ?

- Issue caller with instructions for immediate life saving / fire fighting or other appropriate actions if it is safe to do so.
- Advise caller of your action plan as appropriate

1B.2 Notify Third Party Companies

- If the disaster involves any of the third party companies on site then the responsible person (s) must be notified immediately.

1B.3 Notify Medical and Fire Authorities

- These services should be immediately requested if appropriate. See Annex 2.

1B.4 Notify Company Personnel

- Alert Company personnel as appropriate and if necessary request them to assemble on site at a certain time to form a Response Team. Delegate this task to one person to save time.

1B.5 Notify Civil Authorities / EPA / Fisheries Board

- If the disaster requires the involvement of the civil authorities then they should be notified immediately. The specific procedure for notifying the EPA is outlined in Annex 3.

1B.6 Media Enquiries

- Any media inquiries should be directed toward the Works Manager or Company Technical Manager.

1B.7 Receive Update

- If possible communicate with caller or site to obtain update on developments.
- Advise site of action which has been taken.
- Advise site of appropriate further actions until Response Team arrive.

1B.8 Assemble an Appropriate Response Team

- On arrival on site Response Team should quickly brief themselves of situation and if necessary first attend to life saving measures.

Stage 2 – Immediate Response Action

2.1 Initiate Evacuation Procedure if Appropriate

- Evacuate all personnel from building or area under threat.
- Assemble in a safe location away from disaster area.
- Designated Assembly Points are located at the following locations:
  - Front of Engineering Building
  - Car Park in front of Production Building
  - Outside Packing Plant
  - In Front of Quarry Offices
  - Head Office Car Park

2.2 Render Medical Assistance if necessary

- Assist as necessary to aid those in need of medical attention until the proper authorities arrive. If possible medical assistance should be given by a qualified first aid person.

2.3 Identify Personnel Casualties

- Identify any personnel casualties that may have occurred as a result of the disaster and as soon as practical record details of the injured person and injury and the subsequent action taken.

2.4 Assemble Response Team

- Assemble appropriate personnel in to a Response Team and issue clear 'action required' instructions to each member.

2.5 Send Home Non-Essential Personnel

- If appropriate send home non-essential personnel until further notice and advise them to refer the media or other outside concerns to the plant management for any comment on the situation.

2.6 Protect Premises, Plant and Environment

- Once all life threatening situations have been addressed and casualties attended to actions must be immediately identified to protect premises, documentation, plant and equipment and the environment. The emergency response procedure for dealing with environmental emergencies is outline below

2.7 Notify Insurance Company

- If appropriate notify insurance company giving as much information as necessary via Head Office.

Pembroke International Insurance Company Ltd

22 Pembroke St

Dublin 2

Stage 3 – Post Disaster Plan

- In the aftermath of the disaster, an assessment must be carried out on its impact and an appropriate contingency plan devised.

3.1 If Operations have stopped

- How long will stocks last to meet demands?
- Identify priorities and likely timescales to re-establish operations.

3.2 If Plant is out of Commission

- How long with stocks last to service customers?
- Evaluate damage and decided on repairs route or contract plant hire.
- Advise Head Office

3.3 Environmental Disaster

- The Environmental Manager should inform the Environmental Protection Agency and any other relevant Authorities, as per Condition 11 of the IPPC Licence. The procedure for notifying the EPA is outlined in Annex 3.

Emergency Response - General

- **Proceed to Accident Location**
  - Shift supervisor should go immediately to the location of the accident to evaluate the situation.

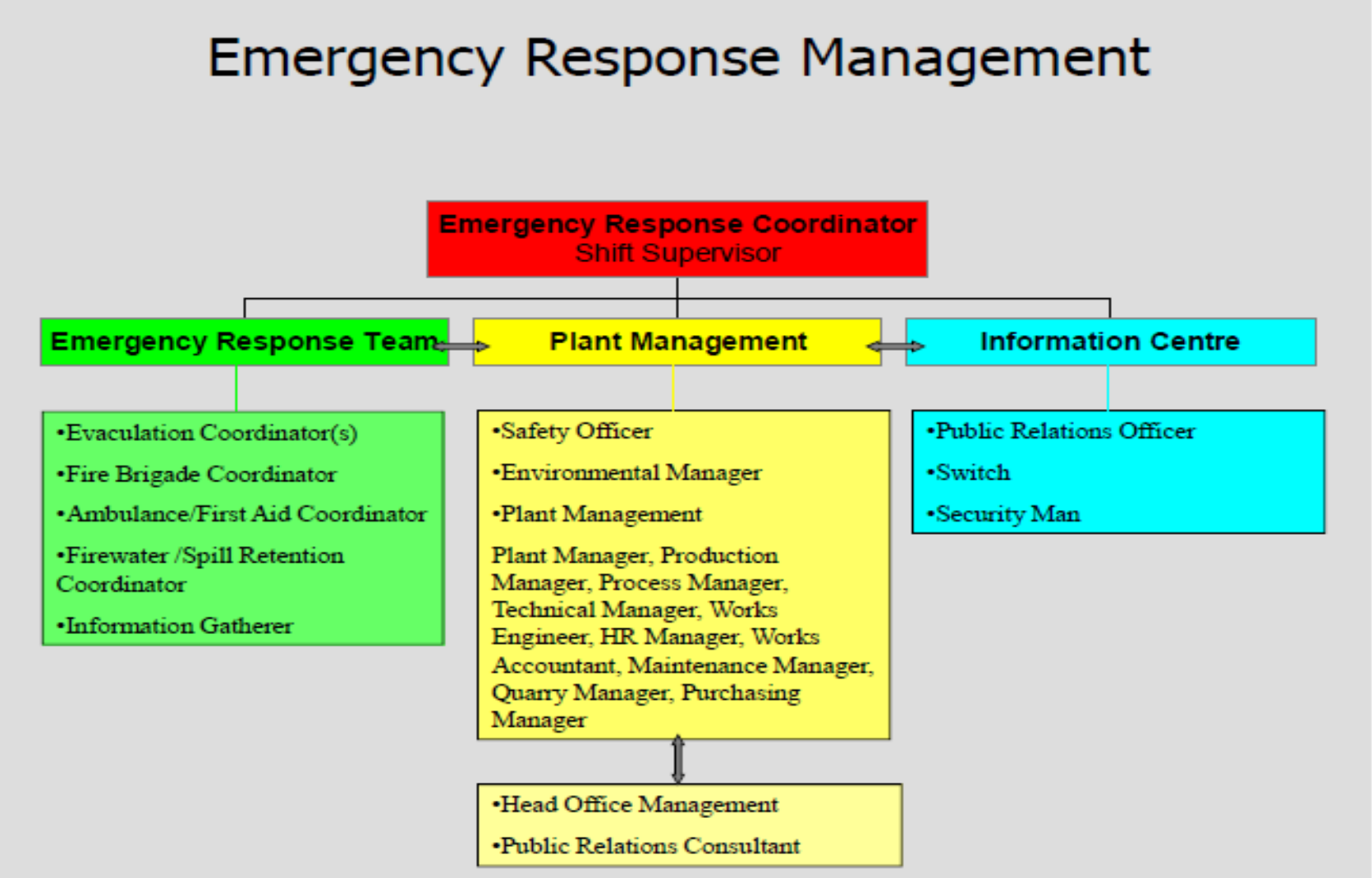
- **Initiate Evacuation Procedure if Appropriate**
  - Sound the fire alarm, and evacuate all personnel from the building or area under threat.
  - Instruct personnel to assemble at a designated assembly point away from the disaster area.
  - Nominate a staff member for a personnel roll call and account for the whereabouts of all staff members.
  - Nominate a staff member to meet the emergency services at the appropriate entrance and guide them to the scene of the emergency.

- **Render Medical Assistance if necessary**
  - Assist as necessary to aid those in need of medical attention until the proper emergency services arrive. Any qualified first aid person should be called as required to give medical assistance.
  - First aid people should obtain any medical supplies/resuscitators required from the following locations: Central control building-First aid room, Main office building-First aid room, Garage-First aid box in canteen, Despatch area-First aid box in road bulk loaders office, Quarry-Supervisors office.

- **Identify Personnel Casualties**
  - Identify any personnel casualties that have occurred as a result of the disaster and as soon as practical record details of the injured person and injury.

- **Assemble Response Team**
  - Assemble appropriate personnel into a Response Team and issue clear instructions to each member.
  - The first priority must be to remove any threat to human life.
  - The response team may assist the emergency services as required. The team must also try to prevent the emergency from developing further.
  - The team should assist in preventing any damage to the environment by building bunds or blocking drains as appropriate (see environmental section).

- **Send Home Non-Essential Personnel**
  - If appropriate send home non-essential personnel until further notice and advise them to refer the media or other outside concerns to the plant management for any comment on the situation.



Further details of each coordinator function is included in Annex 4.

Emergency Response – Fire

- A set of fire fighting and emergency rescue equipment including the high expansion foam generator, is located at the Central Fire Point under Kiln No.1 drive station.
- Fire fighting water hydrants and fireboxes are located as shown on the site risk map.
- Various types of fire extinguishers are located at points around the Works shown on the site risk map.
- Drogheda Fire Brigade is always available at 041-9832222 or Navan 046-9021666. Give your mobile no. and ensure someone is waiting at site entrance for arrival of the fire services, with a copy of the site risk map.
- Internal fire alarms should be sounded.
- When using an extinguisher, follow the instructions for that extinguisher- Ensure that the correct extinguisher is being used.
- Assist in fighting the fire using an appropriate extinguisher only if it safe and you are confident to do so.
- If the fire can no longer be contained, then vacate the building/work area immediate by the nearest clear exit, closing all doors behind you.
- Personnel should proceed to the designated assembly point.
- Personnel should report to the assembly point controller and identify themselves
- The person who discovered the fire should inform the shift supervisor of the situation at the scene of the emergency, outlining how far advanced the fire or emergency was as they left it.
- If possible erect a barrier/bund to contain the firewater and block the surface drains. See spill emergency response section.
- Lift the buoy on the Storm Water Tanks in the Water Treatment Plant to retain any firewater /spill in the tanks, and prevent it entering the river Nanny.
- In the case of a major fire a bund/barrier should be erected to contain the firewater and prevent it entering the drainage system. Request that the quarry stop the quarry surface water pumps.

- Fire Fighting Equipment & Usage
  - Water hydrants
  - Fire fighting equipment boxes containing stand pipes, hoses, keys, nozzles.
  - Hose reels
  - High expansion foam generator, used for fires in the cable tunnels or in the coal mill filters
  - Water fog/spray: used for Class A fibres, carbonaceous materials, textiles, paper timber etc.
  - Dry powder: Class B fires

SRF System – Fire detection & suppression

TULS system

The TULS system is designed for unloading trucks and transporting SRF to the storage bays. Hence it is not envisaged that SRF material will be present in this system for long periods of time.
There is no direct fire suppression system in this area
In the event of a fire either (a) the fire brigade or (b) hoses from the hydrants, will be used to extinguish the fire.
Water from this area will either be collected in the sump below the TULS (automatically pumped to drain) or run off from the ground to drain
A manual valve in the drain system should be manually closed. This will then direct the run off water to an overflow sump which will then be pumped to the firewater retention bund.

Storage Bays

Four storage bays are available for SRF. Each bay has one fire detector and three temperature probes for fire and heat detection. The fire detector (fire alarm panel) will alarm if the temp exceeds 55degC and the temp probes will alarm on the control system if the temperature exceeds 45 (H) and 50 (HH) alarms. In the event of an alarm the following should completed
Determine from temperature curves as to whether the alarm appears real i.e. rate of temp increase, temp increase is visible on one or more temp probes
Attend top of storage bays to determine if smell of fire is evident.
If safe, the inspection ports on top of the bays can be opened to determine whether fire exists.

If at any stage of the process a fire is determined to be real the following should be completed.
Open manual wheel valve to the relevant storage bay on the south (quarry haul road) side of the storage bays.

Water flow rate is circa 900l/min

Do not put yourself in danger trying to put out a fire. If in doubt call the fire brigade.

Emergency Response – Explosion

- Stop supply of any flammable and combustible material reaching the affected zone, i.e. shutting off of fuel and other flammable liquids. Ensure all sources of ignition are extinguished.
- Prevent access of machinery delivering flammable or combustible material or liquids.
- Remove any machinery containing fuel away from the disaster area.
- Stop all necessary plant.
- Secure any plant and machinery that could cause injury and damage due to it having become destabilised by the explosion.
- Extinguish any fire resulting from the explosion and at the source of the explosion.
- In the case of quarry blasting ‘misfires’, refer to the intranet safety section, procedure 3.24

Emergency Response – Major Industrial Accident

In the event of an industrial accident such as the collapse of a plant item or machinery or a collision of mobile plant:

- Secure and isolate any plant and machinery that have been affected by the accident.
- Isolate the area to prevent any further accident and evacuate and isolate any adjacent areas that have the potential to be affected by the accident.
- In the event of a vehicular collision involving flammable, toxic or dangerous materials the supplier of the materials must be contacted, the material safety data sheet must be consulted and the shift supervisor must decide on the appropriate response.
- In the event of fire or release of material with the potential to harm the environment, consult the relevant section in the emergency response procedure.

Emergency Response – Spill of Flammable or Environmentally Harmful Material

- Platin Works has dedicated spill response kits at locations close to the areas where chemicals/flammables are stored in larger quantities. The spill kit locations are:
  - At the main entrance to the cement milling building.
  - At the diesel/fuel oil tanks at the firing end of kiln 2.
  - The untaxed diesel storage tank opposite the garage.
  - The diesel storage tank at the quarry entrance.
  - At the garage.
  - In the stores.
  - Kiln 3 Diesel Oil Tank

- Each spill kit contains a bag of oil spill absorbent 'green sawdust', absorbing boom and other absorbing devices. Each kit also contains emergency eye wash solution.

- The first priority following a major spill should be the determination what the material is, getting the Material Safety Data Sheet, seeing if the spilled material is flammable and ensuring the response/cleanup team or people nominated to clean the spill are wearing the correct PPE.

- If the spill is flammable, all sources of ignition should be extinguished/removed. If practical, the spillage may be covered with expanding foam to prevent ignition.

- The area must be kept well ventilated if in a confined space.

- Ensure all untrained or unnecessary personnel are kept well away from the area of the spill.

- The material spilling should be stopped and contained as much as possible.

- The material should not be allowed to enter the surface water drainage system. A loading shovel is available to the shift supervisor at all times. The shovel may be used for any of the following containment procedures depending on the situation:

  - If possible a bund or barrier should be built around the spillage to keep the material in place and stop it spreading or entering the drains. The shovel may use limestone fines, shale, overburden or other suitable materials.
  - If the material has the potential to enter the surface drains, the drain in question should be blocked downstream of the blockage using suitable materials mentioned above.
  - Lift the buoy on the Storm Water Tanks in the Water Treatment Plant to retain any firewater /spill in the tanks, and prevent it entering the river Nanny.

- In the case of a major fire a bund/barrier should be erected to contain the firewater and prevent it entering the drainage system. Request that the quarry stop the quarry surface water pumps.

Emergency Response – Ammonia

Ammonia Solution (up to

1. Introduction

This procedure details the actions to be taken in the event of a substantial release of ammonia, which could occur due to any of the following:

- Leaks from pipe work and fittings on the plant;
- Rupture of auxiliary piping or other cause of leakage during deliveries of ammonia solution
- Breach of ammonia solution storage tank due to structural defects or other damage

2. Description of ammonia solution

The ammonia solution onsite is stored in 2*120 (capacity) cubic metre stainless steel, single skinned, storage tank, sited within a bund rated at 110% of the tanks total storage capacity. The amount of ammonia within the tank is limited to 100 Cubic Metres (90 Tonnes). The tank is situated on the West side of the factory at the front of Raw Mill 2. Pedestrian traffic is very low in this area and any traffic past the tanks is generally between 08.00 and 16.00 and is low.

3. Potential affected areas

Ammonia vapour is lighter than air and will tend to disperse readily. If there is a sudden release of large quantities, this may result in a cloud of ammonia vapour. An ammonia cloud is likely to be invisible and will drift with the wind direction. Areas within the site that may be affected will depend on the direction of the wind. Wind direction may be checked by referring to the instrumentation in the CCR. There is also a wind sock on top of the Ammonia tanks for reference.

4. Ammonia solution storage (25% dilution) – Raising the alarm

In the event of an ammonia leak and/or the ammonia detector in the storage tank bund being activated:

- Contact the Shift Supervisor and inform him of the location. Immediately move upwind of the leak. The Shift Supervisor and/or his shift team should investigate the source and magnitude of the leak. Wear all Ammonia PPE at all times. Stop leak at source only if it is safe to do so. Do not approach the area if in doubt.
- The alarm will be audible and visual

- If the alarm is activated in the storage tank bund, the Shift Supervisor will issue a announcement via radio and/or the works PA system warning of a "potential Ammonia leak". He will give a clear indication of wind direction and inform people to go into the nearest building and close the windows.
- Upon hearing this announcement all personnel must make their way indoors and close the windows and await the all clear from the Shift Supervisor or relevant person(s)
- The Shift Supervisor will co-ordinate an investigation into the leak.
- If the alarm is spurious or can be actioned and the area made safe, the Shift Supervisor should plan for this and inform CCR of his decision.
- If there is a major leak or the Shift Supervisor believes that there is the potential for such then he should:
  - Contact the designated Environmental emergency clean away company and the Environmental Coordinator
  - Call the Fire Brigade informing them of the situation.

The fire Brigade will need to know the following information

- *Company name, location and telephone number;*
- *Details of the incident involving 25% ammonia solution;*
- *Wind direction;*
- *Any other relevant information*

- The Shift Supervisor will contact someone to meet the Fire Brigade at the main works entrance.
- The Shift Supervisor will contact the on Duty Security Officer and inform him of the situation and instruct him to stay at his post to ensure the Fire Brigade (And any other emergency service) have access to site.

6. Roll call

All departments will take a roll call of employees and contractors who are working for them. This information will be needed by the Fire brigade, via the SS, should a major incident happen.

- *A Supervisor from each department should take a roll call and note down any person/s unaccounted for with the task/area where they are most likely to be. When called by the SS this information must be passed to them. This must include contractors and visitors.*

- *The Supervisor will contact the CCR and inform them of anyone unaccounted for.*

7. Liaison with the Emergency Services

The Shift Supervisor will meet with the Fire brigade upon arrival to familiarise them with these emergency procedures.

8. First aid treatment

Danger, Response, Airways, Breathing, Circulation.

If you suspect that there is a casualty due to Ammonia vapour contact Supervisor/Team Coordinator to remove the casualty to a safe area.

Vapour inhalation

- Summon medical assistance through CCR
- Keep the patient warm and stationary until help arrives

Ingestion

- Summon medical assistance through CCR
- Encourage the patient to drink large quantity of water
- Do not induce vomiting

Eyes – Splashes or concentrated vapour

- Irrigate eyes immediately
- Summon medical assistance through CCR
- Summon first aider and move patient to fresh air

Skin

- Summon medical assistance through CCR
- Wash immediately, preferably using deluge shower
- Remove affected clothing
- Keep the patient warm and stationary until help arrives

9. Training

Exercises/scenarios of this procedure shall be held periodically to ensure all staff are familiar with it and are aware of its importance

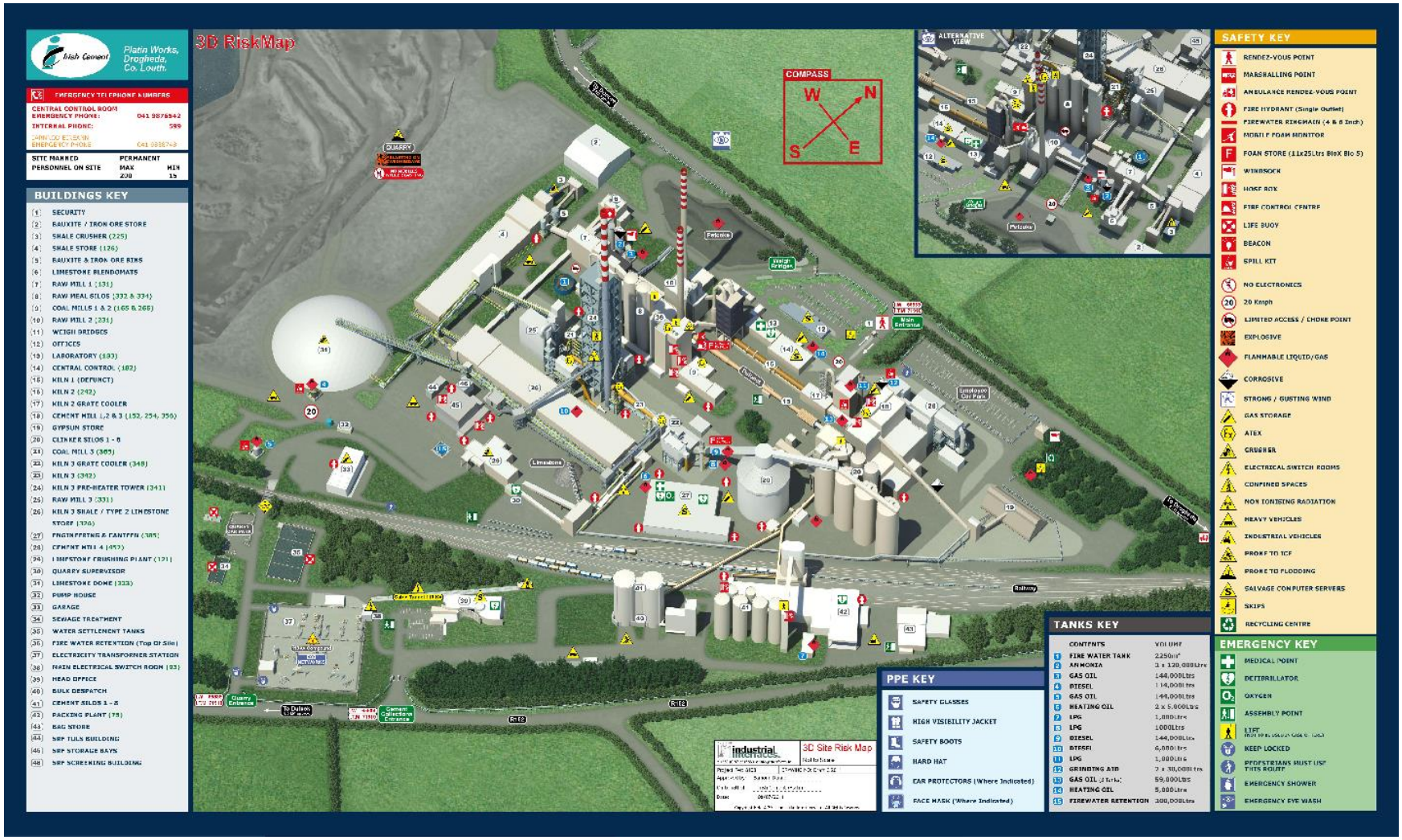
EMERGENCY ADVICE

In the case of actual or imminent leakage of ammonia, advice and assistance may be obtained 24 hours a day by phoning:
0044-1642 452461

Unaccounted For

Department	Name of unaccounted for person	Last known or likely area to be

Annex 1 – Site Risk Map



Annex 2 – Emergency Telephone Numbers

Service	Telephone No.
Fire Brigade Drogheda / Navan	041-9832222 / 046-9021666
Ambulance	041-9837601 / 999 / 112
Garda Station Drogheda/Duleek	041-9874200 / 041-9823222
Lourdes Hospital	041-9837601
R.C. Presbytery, Duleek	041 9823205
R.C. Presbytery, St. Marys Drogheda	041 9838347
Securicor	041 9836066/01 4541351
Health and Safety Authority	1890 289 389
Environmental Protection Agency (EPA) Fax	01 268 0100 / 053-9160600 01 268 0199 / 053-9160699
Meath County Council	046 909 7000
Eastern Fisheries Board	01 278 7022
Health Services Executive, Co. Meath	046 9021595
Food Safety Authority of Ireland	01 817 1300
Plant Management	As per list in control room
General Emergency Services	999 / 112
Ammonia emergency	0044-1642 452461
Spill emergency - ENVA 24hr contact	1850-504 504

Annex 3 - Notification of environmental impact to EPA

The Environmental/Production Manager is responsible for notifying the EPA. When notifying the EPA, the notification can be made electronically via alder or by both phone and by fax, where the incident is categorised as either.

- Category 1 incident Minor (No contamination, localised effects)
- Category 2 incident Limited (Simple contamination, localised effects of short duration)
- Category 3 incident Serious (Simple contamination, widespread effects of extended duration)
- Category 4 incident Very Serious (Heavy contamination, localised effects of extended duration)
- Category 5 incident Catastrophic (Very Heavy contamination, widespread effects of extended duration)

Actions should be taken to minimise the effect on the environment and all details of the incident should be recorded.

In the event that the shift supervisor seems that an environmental incident may impact on neighbours, the above named personnel shall be contacted and the EPA notified of same. An investigation will be carried out, as soon as practicable, to ascertain any potential for future incidents.

In the event of any incident which relates to discharges to water, the Eastern Region Fisheries Board must be notified.

The Environmental Manager is responsible for contacting the EPA, County Council and the Fisheries Board.

The EPA will publish incidents of Category 2 or higher on the web. Before the incident is published a review with site personnel will be conducted by the EPA and the facility will be informed of the intention to post the notification.

Annex 4 – Response coordinator functions

Emergency Response Coordinator

1. Investigate and evaluate the incident immediately
2. If immediate evacuation of a building is required, sound alarm (intercom, fire alarm etc)
3. Telephone Emergency Services immediately (if required),
   - Ambulance 041 9837601/ 999 / 112
   - Fire Brigade 041 9832222 / 046 902 1666
4. Assemble and brief Emergency Response Team
   - Evaculation Coordinator, Fire Brigade Coordinator, Ambulance / First Aid Coordinator, Fire Water / Spill Retention Coordinator, Information Gatherer
5. Distribute PPE and mobile phones to everyone on the Emergency Response Team
6. Notify the Safety Officer (who will in turn notify the H&S Authority and others)
7. Notify the Environmental Manager (who will in turn notify the EPA and others)
8. Notify Plant Management (who will in turn coordinate PR / Media response)
9. Notify Information Centre, i.e. Head Office Switch "9" and Security (who will record any employee / public / media queries or complaints)
10. Coordinate Emergency Response

Annex 4

Evacuation Coordinator(s)

1. If evacuation of a building is required, ensure the alarm in the building is being sounded (intercom, fire alarm etc.)
2. Do not enter the building
3. Gather evacuated persons at a safe designated assembly point and record all names
4. Determine a list of missing persons
5. Notify the Ambulance / First aid Coordinator of any injured persons
6. When the evacuation is complete, send all evacuated persons to a safe building where all persons will be briefed by Plant Management on the incident before being sent home
7. Report progress to the Emergency Response Coordinator
8. Report to the Information Gatherer; the names of all evacuated persons, the names of evacuated persons sent home, names of any missing persons

Annex 4

Fire Brigade Coordinator

1. Confirm the Fire Brigade's expected time of arrival and give the Fire Brigade your mobile phone number
   - Fire Brigade 041 9832222 / 046 902 1666
2. Collect the Fire Hydrant Map from the Control Room
3. Wait at the factory entrance for the Fire Brigade to arrive and direct them immediately to the fire
4. Using Fire Hydrant Map, direct the Fire Brigade to the nearest fire hydrants
5. Inform the Fire Brigade of the Irish Cement fire fighting and emergency rescue equipment (including the high expansion foam generator), which is located at the Central Fire Point under Kiln No.1 drive.
6. Inform the Fire Brigade any Diesel / Chemical / Gas storage tanks that are near the fire
7. Do not get involved in fire fighting
8. Liase with the Firewater retention Coordinator to ensure fire water is retained
9. Report progress to the Emergency Response Coordinator
10. Report to the Information Gatherer (for each Fire brigade that arrives);
    - Arrival time, fire fighters names, departure time

Annex 4

Fire Water/Spill Retention Coordinator

1. Request that the Quarry stop the Quarry Surface Water pumps
2. Request that the Quarry lift the buoy on the Storm Tanks in the Water Treatment Plant to retain any fire water / spill in the Tanks, and prevent it entering the River Nanny
3. Identify water drains near the incident where the fire / spill has occurred
4. Request the Quarry install a temporary firewater retention berm of clay/stone at the area of fire / spill to protect the firewater or spill entering the water drains. Ensure that access to and from the incident site for the Ambulance(s) and Fire Brigade(s) is not restricted.
5. Coordinate retained firewater / spill clean up,
   - Consult Safety Data Sheets of spillage material to ensure clean up is carried out in a safe manner
   - Spill kits are located around the site at all Diesel and Chemical tank bunds, containing absorbent 'green sawdust' and other absorbing devices.
   - If a large quantity of firewater / spill has been generated that is not suitable for going to drain or for cleaning up, an external contractor will be requested to come on-site and collect the liquid.
6. Report progress to the Emergency Response Coordinator
7. Report progress to the Environmental Manager

Annex 4

Information Gatherer

1. Record the following information (supplied by the Emergency Response Coordinator and Team)

- Time of Incident (i.e. fire / explosion / spill / building collapse)
- Names of all evacuated persons, the names of evacuated persons sent home, names of any missing persons
- For each fire brigade unit that arrives, record the,
  - Arrival time, fire fighters names, departure time
- For each ambulance that arrives, record the,
  - Arrival time, Ambulance medical staff names, names of injured persons taken in Ambulances, departure time

2. As information becomes available, inform the Emergency Response Coordinator and Plant Management

Appendix 4 – Construction and Environmental Management Plan

Irish Cement Ltd.

Development for Expansion of Alternative Fuels and use of Alternative Raw Materials

Construction and Environmental Management Plan

REP1

Final | 1 June 2017

Job number 325374-47

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ARUP

Document Verification

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Contents

1 Introduction

This outline construction environmental management plan (CEMP) includes a description of the proposed works and the controls and monitoring activities put forward to ensure that potential negative effects are minimised.

This outline will be further developed by the contractor appointed to construct the development. Any significant variations to this document will be advised to the planning authority in advance of the relevant construction works taking place.

2 Project Description

2.1 Site Description

The location of Platin Cement Works is between Drogheda and Duleek, Co. Meath. The junction between the R152 Drogheda to Kilmoon cross regional road and the CR311 country road is directly northeast of the site, while Junction 8 (Drogheda South) on the M1 Dublin-Belfast motorway is located c. 0.75km northeast of the site.

Irish Cement Ltd. also operates a quarry adjacent to site. This quarry extracts limestone which is the primary raw material used in the cement making process at Platin Cement Works.

The site for the proposed development extends to c.22.5 hectares centrally located within the c.40 hectares of Platin Cement Works. The Drogheda-Navan railway crosses the Cement Works, dividing it into two separate areas. The main cement production area is located to the north/northwest of the railway, while the cement dispatch/output area, ESB sub-station and Irish Cement Ltd. offices are located to the south/southeast of the railway.

The proposed development area where construction is planned to occur is c. 22.5 hectares in size and is located within the cement production area to the north/northwest of the railway (see **Figure 1**).

Two cement kilns are located within the Platin Cement Works site; Kiln 2 and Kiln 3. Only Kiln 3 is currently operational.

2.2 Development Description

Irish Cement Ltd. is making an application to An Bord Pleanála for a 10 year planning permission for development to increase replacement of fossil fuels with alternative fuels and to allow for the use of alternative raw materials at the Platin Cement Works, Co. Meath.

The proposed development aims to allow for an increase of 480,000 tonnes per annum of locally sourced alternative fuels and alternative raw materials to be used in both Kiln 2 and Kiln 3 as a replacement for the existing use of imported fossil fuels. This is planned to take place gradually over a number of years and is dependent on the availability of suitable alternative fuels. Proposed alternative fuels to be used include:

- fine solids (e.g. SRF, chipped timber, shredded plastics)
- coarse solids (e.g. shredded wood, rubber, dry filter cakes)
- free flowing solids (e.g. secondary liquid fuels (SLF), waste oils, sludge)
- pumpable fluids (e.g. solvents, distillation residues)

The proposed development also aims to make use of alternative raw materials for the cement making process, including materials such as alum filter cake, soils, stones, dust etc.

To allow for the proposed replacement of fossil fuels with alternative fuels, a number of buildings, silos and associated conveyors, etc. for the receiving, handling and introduction of alternative fuels to the cement plant will be constructed gradually over time.

Further details regarding the proposed structures to be constructed on site are presented in **Section 3**.

3 Construction Activities

3.1 Introduction

This section describes the main activities involved in the construction of the proposed development.

3.2 Construction Schedule

Construction is scheduled to be carried out on a gradual basis over a period of approximately 10 years, subject to planning and other approvals.

The general sequence of construction will be divided into short term, medium term and long term phases of activities. Short term indicates that the structures are

planned to be completed within 0-4 years, medium term within 3-7 years and long term within 6-10 years.

While the above phases are proposed, an overlap of timing is likely to occur between them. Construction activities within each phase will generally happen in sequence but a lot of the activities will run in parallel with one another.

Table 1 details the proposed structures, together with the general sequence in which they are likely to be constructed. Locations referenced in **Table 1** are shown in **Figure 1**.

Table 1 List of Proposed Structures for Alternative Fuels Expansion

Details of Proposed Structures (with reference to location as indicated on Figure 1)	**Approximate Overall Building Dimensions (LxWxH)(m) Silo Dimensions (HxDia)(m)**	**Proposed External Treatment of Walls/Roof**
Short-Term		
1a. Fine Solids Building for Kiln 3 (As an extension to existing Fine Solids (SRF) building)	Building c.17m x 29m x 16m	Exposed cast concrete, steelwork & metal corrugated cladding
Fire-water Retention Tank (i.e. relocation on existing tank, which is to be demolished)	Concrete tank c.16.6m x 10.6m x 2.5m high on concrete pad c. 18.6m x 11.6m	Exposed cast concrete & steelwork
2. Proposed Pumpable Fluids Tanks for Kilns 2 and 3	2 no. Tanks c.9m x 8.24m dia. 1no. Tank c.9m x 5m dia.	Exposed cast concrete, steelwork and metal corrugated cladding
Bunded Area surrounding tanks	420sq.m enclosed by 2m high wall	Exposed cast concrete and steelwork
Tanker off-loading area	Concrete yard of c.23m x 10m, with 25m3 underground storage sump. Enclosed by 2.5m security fence	Exposed cast concrete, & steelwork
3. Proposed 'Free Flowing' Solids Silos for Kiln 3	2 no. silos c.26m x 5.5m dia.	Steel silos/tanks and steelwork
Bunded Area	9.2m x 15.1m x 4m high	Exposed cast concrete & steelwork
4. Alternative Raw Materials Building for Kilns 2 & Kiln 3	Building c.53.7m x 53m x 14.3m	Exposed cast concrete, steelwork & metal corrugated cladding
Fire-water Retention Tank	13.6m x 10.6m x 2.5m high on concrete pad c. 14.6m x 11.6m	Exposed cast concrete & steelwork

Medium-Term		
5 Proposed general Fine Solids Building for back end of Kiln 2 Fire-water Retention Tank	Building c.26 x 49.5 x 8m Concrete tank c.9.6m x 9.6m x 2.5m high on concrete pad c. 10.6m x 11.6m	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork
6. Proposed 'selected' Fine Solids fuel introduction / metering structures for front end of Kiln 2	Building c.7.5m x 6m x 26.7m 2 no. truck off-loading stations c.4m x 7.5m x 5.5m and c.35m length of conveyor	Exposed cast concrete, steelwork & metal corrugated cladding
Longer-Term		
7. Tyre Storage and Handling Area Tyre Intake Station and Conveyor Transfer Station and Conveyor Fire-water Retention Tank	Height 835 sq. m x 3m high c.18 x 16 x 30 plus c. 57m proposed conveyor. c.8.5 x 5.5 plus c 55.3m proposed conveyor Concrete tank c.9.6m x 9.6m x 2.5 high on concrete pad c. 10.6m x 11.6m	Exposed cast concrete. Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork
8a. Proposed Coarse Solids handling building for Kiln 2 & 3 Fire-water Retention Tank 8b. Conveying Building and Conveyors for Kiln 3	Building c.97.5m x 50m x 12.15m 13.6m x 10.6m x 2.5m high on concrete pad c. 14.6m x 11.6m c.18m x 16m x 30.5m plus c.83m of proposed conveyor	Exposed cast concrete, steelwork & metal corrugated cladding Exposed cast concrete & steelwork Exposed cast concrete, steelwork & metal corrugated cladding
9. Proposed Free-flowing Solids for Kiln 2. Bunded Area	2no. silos c.26m x 5.5m dia. 9.2m x 15.1m x 4m high	Steel silos/tanks & steelwork Exposed cast concrete & steelwork
10. Bypass Filter for Kiln 2	c.9m x 15m x 24m, with cooling tower to c.46m x 5.0.2m dia.	Steel, steelwork & ductwork
Proposed Coarse Solids for Kiln 2 (makes use of same building as provided under Item 7a above.)	Makes use of same building as provided under Item 7a above. c.16m x 18m x 30.5m	Exposed cast concrete, steelwork & metal corrugated cladding.

11. Truck off-loading / elevator / buffer building Transfer Station	c.8.5m x 5.5m x 38.5m plus c.200m of proposed conveyor	Exposed cast concrete, steelwork & metal corrugated cladding. Exposed cast concrete, steelwork & metal corrugated cladding

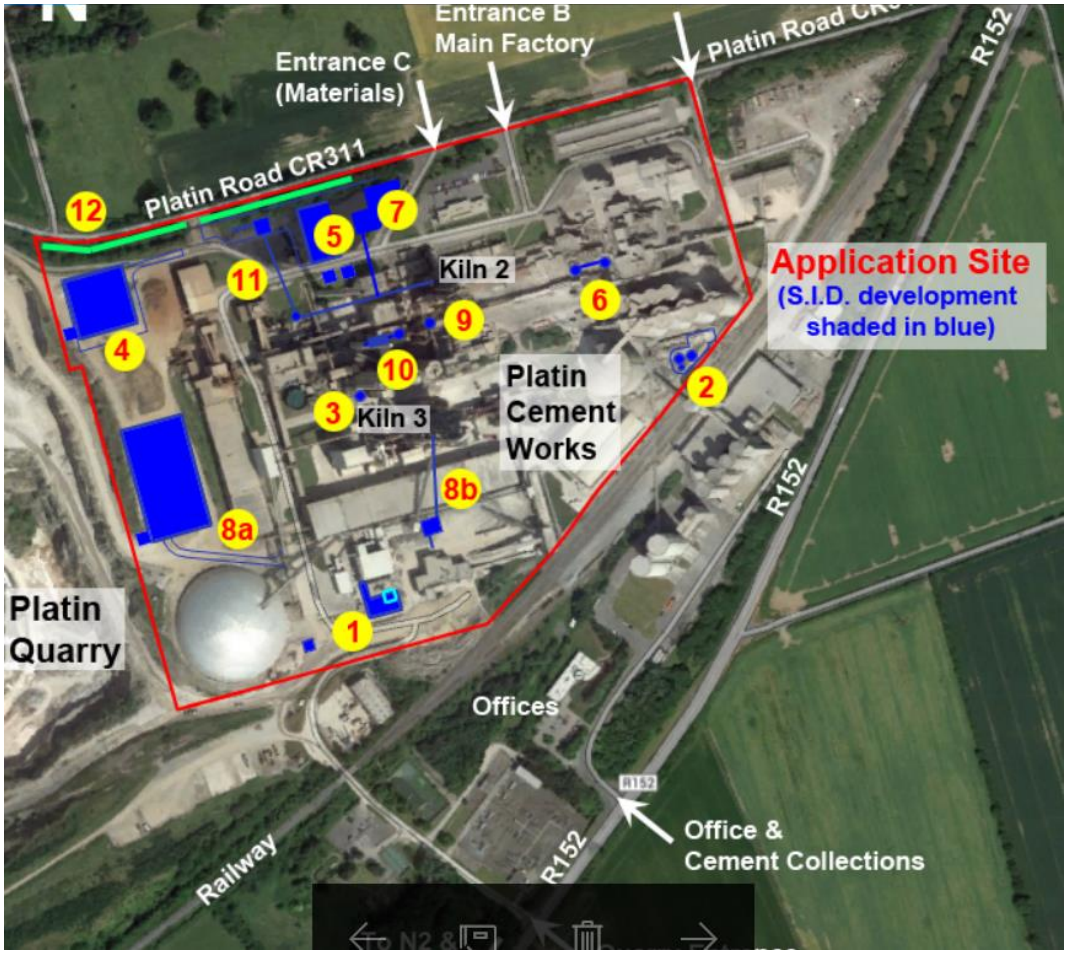

Figure 1 Locations of proposed structures

4 Method Statement for Construction

A detailed Environmental Management Plan and Construction Health and Safety Plan will be developed by the contractor appointed to carry out the works.

4.1 Site Preparation Works

Site preparation works will include the 'site establishment' set up by the contractor which will include the following:

- Setting up of access control to the site;
-
- Erection of site office;
- Site facilities (canteen, toilets, etc.);
- Office for construction management team;
- Secure compound for the storage of all on-site machinery and materials;
- Permanent and temporary fencing;
- Erection of signage.

Prior to commencement of construction, the contractor will consult Irish Cement Ltd. records and drawings to establish the location of existing buried services.

4.2 Construction Compound

A temporary construction compound will be required for each phase of construction. This will be located within the Platin Cement Works site.

The temporary construction compound will include a site office for the construction management team and site facilities for the construction staff. The compound will be serviced with electrical power, water supply and toilet facilities. It is envisaged that the existing Platin Cement Works facility will supply these services. If not, electrical power will be supplied from a low noise, double bunded diesel generator sited within the compound, water will be delivered to the site by bowser and sewerage/effluent will be stored in septic tanks and removed from site. The compound will be used as a storage area for the various components, fuels and materials required for construction. The compound will be fenced off to ensure site security is maintained. The compound will be decommissioned and reinstated to its original condition at the end of the construction period.

4.3 Construction of New Structures

The development comprises the construction of a number of new structures, including buildings, silos and associated conveyors, etc. These structures are detailed in **Table 1**, presented in **Section 3.2**.

These structures will vary in size but will generally be of low elevation when compared with existing structures within the site. The proposed structures will be in keeping with the existing character of the site, with a mixture of exposed cast concrete, steelwork and corrugated sheeting used for their construction.

4.4 Construction of Services

4.4.1 Electrical Connections

Power will be required for the construction compound. It is anticipated that power will be required for temporary lighting and temporary signals during the works. If a connection to the existing network is not available a generator will be used.

4.4.2 Surface Water/Drainage System

No new surface water services will be constructed as part of the proposed development.

Construction activities will be carried out within the catchment area of the current site drainage system. This drainage system discharges under an IE licence to an outfall point into the River Nanny. Prior to discharge to this point, surface water from the site passes through balancing and settlement tanks which remove suspended solids and oil interceptors and absorbent booms which remove any accidental oil or hydrocarbon spills.

4.4.3 Potential for Historic Contamination on the Site

Based on the soil baseline survey carried out all relevant limits for contaminated soils were complied with.

In the event of any evidence of soil contamination being found during the excavation phase of the construction works, the appropriate remediation measures will be employed. Any work of this nature will be carried out in accordance with the appropriate waste management legislation.

4.5 Health and Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared by the Contractor which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

Safety on site will be of paramount importance. During the selection of the relevant contractor and the respective subcontractors their safety records will be investigated. Only contractors with the highest safety standards will be selected.

Prior to working on site, each individual will receive a full safety briefing and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. ‘Toolbox talks’ will be held to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure that the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

4.6 Materials – Source and Transportation

The selection and specification of construction materials will be informed by the local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible.

4.7 Employment and Accommodation

While there will be some variation in numbers working on site throughout construction, it is anticipated that approximately 30 workers will be employed during each phase of construction.

Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard in accordance with statutory regulations as a minimum.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phases. A construction management plan will be put in place prior to the commencement of the works. This plan will designate traffic routes, timings and parking arrangements.

Typical working hours during the construction phases would be envisaged as:

Start	**Finish**	
07:00	19:00	Monday – Friday
07:00	14:00	Saturday

Currently, there are no significant works foreseen outside of normal working hours.

5 Potential Construction Phase Environmental Effects and Control Measures

5.1 Introduction

The construction activities described in **Section 3** will have a range of effects. This section describes the likely consequences of the works and outlines the proposed control measures that will minimise potential environmental impacts.

The potential construction phase impacts include emissions to air such as dust, noise and vibration, construction traffic, and poorly controlled construction waste. Surface water run-off from the site during periods of heavy rainfall and leaks or spills from construction plant and equipment have the potential to impact on the quality of soils, surface water and groundwater.

5.2 Noise

The construction phase of the proposed development will involve minimal site demolition works, site clearance, excavation and the construction of buildings and structures associated with the proposed development. A variety of items of mobile plant will be in use, such as excavators, breakers, lifting equipment, dumper trucks, compressors, generators and pile drivers. There will be vehicular movements to and from the site that will make use of the existing roads and site access points.

A number of measures will be employed by the contractor in order to minimise the potential noise and vibration disturbance in the surrounding area and to ensure compliance with the construction noise limits set in the current EPA licence for the site.

BS 5228 (2009+A1:2014) *Code of practice for noise and vibration control on construction and open sites – Noise and vibration* provides guidance on the implementation of measures to reduce the impact of construction noise and vibration.

The measures to be implemented on site include, but are not limited to;

- Selection of plant/location of plant
- Prior to deployment of construction plant on site, an assessment of the noise characteristics of each of the individual plant items in terms of noise and vibration emissions will be undertaken. Where possible, plant which will have the least impact in term of noise will be selected. In addition, plant will only be left running during works and will be switched off at all other times. Plant will not be left idling.
- Hours of work - all construction related works, other than emergency works, security and pumping out of excavations will be carried out during normal construction working hours.

5.3 Dust

Based on the assessment criteria presented in the Transport Infrastructure Ireland (TII) document *'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* 2011, the proposed construction site is considered to be at a 'minor' scale. This category of site has the potential for significant soiling impacts within 25m; PM_{10} impacts within 10m; and vegetation impacts within 10m of the site boundary if standard mitigation measures are in place.

As no sensitive receptors are located within 25m of the areas of the proposed construction works, no significant impacts due to construction activities are envisaged.

Nonetheless, measures will be undertaken during the construction works to minimise dust generation. The following measures will be implemented at a minimum:

- Spraying of exposed earthwork activities and site haul roads during dry weather.
- Control of vehicle speeds on site.
- Sweeping of hard surfaces on-site and in the surrounding area, as required.

Dust deposition monitoring is required by Irish Cement's Industrial Emission Licence on a quarterly basis. Dust deposition monitoring will be carried out and compared to the limit of 350mg/m^2/day (averaged over a 30-day period) to ensure the effectiveness of the measures outlined above.

An outline dust minimisation plan has been prepared and is included in Appendix 8.1.

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily inspections will be undertaken to monitor tidiness.
- A regular program of site tidying will be established to ensure a safe and orderly site.
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site.
- Loaded lorries, delivery vehicles and all trucks for the movement of materials on and off site will be covered. Skips will also be covered. Contractors will ensure that delivery agents are compliant in this regard.
- Surrounding roads used by trucks to access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required. Roads will be cleaned subject to local authority

requirements. Site roads will be cleaned on a daily basis, or more regularly, as required.

- Road edges and footpaths will be cleaned using a hand broom with controlled damping.
- Wheel wash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at all exits from the site.
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

5.4 Soils, Geology and Groundwater

The employment of the following good construction management practices will minimise the risk of pollution of soil, geology and groundwater:

- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the site during construction, and the proper use, storage and disposal of substances and their containers will prevent soil contamination.
- Material such as, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall also be adequately secured against vandalism and will be provided with proper containment according to codes of practice. Any spillages will be immediately contained and contaminated soil removed from the site and disposed of in a licensed waste facility.

5.5 Surface Water

Surface construction activities may pose a potentially significant risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off. Surface water run-off from surface construction activities has the potential to become contaminated. The main contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on site toilet and washing facilities; and
- Concrete/cementitious products: arising from construction materials.
- These pollutants pose a temporary risk to surface water quality for the duration of construction if not properly contained and managed.

Suspended solids, which can include silt, affect surface water turbidity and are considered to be the most significant risk to surface water quality from construction activities. Suspended solids can also reduce light penetration, visually impact the receiving water and damage the ecosystem. Potential construction activities that could generate suspended solids include:

- Water removal from surface excavations as a result of rainfall or groundwater seepage;
- Runoff from exposed work areas and excavated material storage areas; and
- Washdown areas: The potential for washdown containing cement to increase the pH of water above a neutral range, that is typically pH 6 to 9, could pose a threat to aquatic species living in a watercourse.
- Potential activities that could generate the other pollutants listed above include:
- Inappropriate handling and storage;
- Leakage of temporary foul water services; and

Solid (municipal) wastes entering the watercourses or drainage systems.

All construction activities will be carried out within the catchment area of the site drainage system. All surface water from the site passes through balancing and settlement tanks and these are effective in removing suspended solids. In addition, oil interceptors and absorbent booms in the existing surface water treatment system are effective in removing any accidental spills of oils or other hydrocarbons

Prior to construction the Contractor will be required to develop a detailed Environmental Management Plan which will incorporate the mitigation measures detailed below. These mitigation measures apply for the prevention of pollution to all waters during construction.

- Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or a non-compliance incident. This plan will contain the following information:
    - Containment measures;
    - List of appropriate equipment and clean-up materials;
    - Maintenance schedule for equipment;
    - Details of trained staff, location, and provision for 24-hour cover;
    - Details of staff responsibilities;
    - Notification procedures to inform the relevant environmental authorities;
    - Audit and review schedule;

- Telephone numbers of Meath County Council Drainage and Pollution Control Divisions; and
- List of specialist pollution clean-up companies and their telephone numbers.
- Ensure site staff are trained in the implementation of the Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas/discharge to combined sewer. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities.

The Contractor will comply with the following guidance documents:

- CIRIA – *Guideline Document C532 Control of Water Pollution from Construction Sites* (CIRIA, 2001) and
- CIRIA – *Guideline Document C624 Development and Flood Risk - guidance for the construction industry* (CIRIA, 2004).

5.6 Waste Management

This section describes the measures to mitigate the significant impacts for the construction phase of the proposed scheme.

The recommended mitigation for the demolition, excavation and construction phases of the scheme comprises the preparation of a Construction Waste Management Plan which meets the requirements of the *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects* (DoEHLG, 2006a). Where waste generation cannot be avoided this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental impact.

Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material cannot be re-used within the proposed works it will be disposed of accordingly by an authorised contractor.

The contractor will ensure that any off-site facilities to which construction waste is delivered have the appropriate Certificate of Registration, Waste Facility Permit or Waste Licence in place.

In addition to the above during the construction phase the following mitigation measures are proposed:

- Source Segregation: Where possible metal, timber, glass and other recyclable material will be segregated during demolition works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- Material Management: '*Just-in-time*' delivery will be used so far as is reasonably practicable to minimise material wastage; and
- Waste Auditing: The Contractor will record the quantity in tonnes and types of waste and materials leaving site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material whether is recovered or disposed of.

6 Environmental Emergency Response Plan

Emergency response preparedness will be addressed in detail by the selected contractor, in consultation with Irish Cement's on-site EHS team.

Environmental emergencies at the site requiring intervention may include:

- Discovery of a fire within the site boundary
- Uncontained spillage/leak/loss of containment incident
- Discovery of material of archaeological interest

A list of site emergency contact numbers and the general emergency response actions will be compiled by the contractor and posted at strategic locations throughout the site, such as the site entrance, safety stop-boards and contractor cabins. The emergency contact number list will be updated by each contractor to include their Safety Representative contact name and telephone number.

An example of emergency response actions is as follows for action to be taken in the event of a spillage:

- IF SAFE, stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- IF SAFE (USE PPE), contain the spill using the absorbent spills material provided. Do not spread or flush away the spill.
- Cover or bund-off any vulnerable areas where appropriate.
- If possible, clean up as much as possible using the absorbent spills materials.

- Do not hose the spillage down or use any detergents.
- Contain any used absorbent material so that further contamination is limited. Note: This material is a waste and must be treated as such. The Safety Data Sheet (SDS) for the material will determine whether the spill material is hazardous or non-hazardous and will need to be disposed of accordingly.
- Notify the Irish Cement Ltd. Construction Safety Representative at the earliest opportunity.
- An incident investigation will be performed in accordance with procedures and the report sent to the Irish Cement Ltd. Safety Representative.

The Construction Manager will ensure that fully detailed records are maintained of any "incident/event" likely to cause harm to the environment. Contractors who report an incident will ensure details are identified and recorded.

Environmental incidents will be recorded on an appropriate form.

Complaints and Follow up Actions on the construction site will be managed by the Construction Manager in liaison with Irish Cement Ltd. and contractors will ensure that all complaints are recorded according to Irish Cement Ltd. requirements. A complaints log will be kept, and any complaint from interested parties will be actioned and recorded.

Each contractor will be responsible for ensuring that a full record and copy of all **Safety Data Sheets (SDS)** pertaining to their works is kept on file and up to date in their site offices. Contractors will also retain a duplicate copy of all SDSs held by the contractors.

7 References

CIRIA (2001) *Guideline Document C532 Control of Water Pollution from Construction Sites*

CIRIA (2004) *Guideline Document C624 Development and Flood Risk - guidance for the construction industry*

Appendix 5 – Ecological and Sediment Study of the River Nanny (Ecofact, 2016)

Irish Cement Ltd.
Integrated Pollution Control License Register Number P0030-04.

AQUATIC MONITORING OF THE RIVER NANNY NEAR DULEEK, CO. MEATH

(2016 Report)

Version: 31st August 2016

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1. INTRODUCTION

1.1 Background

Irish Cement Ltd. operates a large limestone quarry and cement manufacturing facility at the Platin Works near Drogheda, County Louth. The trade effluent from this site is discharged into the River Nanny near Duleek, Co. Meath. This discharge is licensed by the Environmental Protection Agency (EPA) under Integrated Pollution Control (IPC) License Register Number P0030-04. This license has a number of conditions in relation to the monitoring of the receiving water. The current assessment addresses the receiving water monitoring issues in relation to the following conditions as follows:

- *Condition 6.14.1 The licensee shall annually evaluate the impact, if any, of the discharge to the River Nanny. The evaluation shall be based on the ambient sampling required under Schedule C.6 Ambient monitoring [receiving water monitoring]. In particular the evaluation shall consider the impact of fine particulate matter in the discharge*

- *Condition 6.14.2 The licensee shall, if necessary, based on the results of the evaluation incorporate additional mitigation measures for the treatment of surface water prior to discharge.*

- *Condition 6.14.3 The acute toxicity of the undiluted final effluent to at least four aquatic species from different trophic levels shall be determined by standardized and internationally accepted procedures and be carried out by a competent laboratory. The name of the laboratory and the scope of testing to be undertaken shall be subject to the agreement of the agency. The testing shall be carried out within three months of the date of grant of this license. Copies of the complete reports shall be submitted to the agency within 6 weeks of completion of the testing.*

- *Condition 6.14.4 Having identified the most sensitive species outlined in Condition 6.14.3, subsequent compliance toxicity monitoring on the two most sensitive species shall be carried out annually by the laboratory identified in Condition 6.14.3, or an alternative as may be agreed. Copies of the complete reports shall be submitted to the agency within 6 weeks of completion of the testing.*

- *Condition 6.14.5 A representative sample of effluent shall be screened annually for the presence of organic compounds and heavy metals. The specification of such shall be amended upon the instruction of the Agency. Copies of the complete reports shall be submitted to the Agency as part of the AER.*

This study provides all the required information and meets these conditions. The current study was undertaken by Ecofact Environmental Consultants Ltd. and follows a similar assessments completed in from 2008 to 2015 as part of the requirements for the same discharge license. (Ecofact, 2008 to Ecofact, 2015).

1.2 The River Nanny

The River Nanny (OS Catchment No: 160; EPA code: 08N01) is located in County Meath in the Eastern River Basin District (Hydrometric Area 8). The River Nanny rises near Kentstown and flows east through Duleek and Julianstown to enter the sea at Laytown, roughly 6 km south of Drogheda. Overall it has a total length of approximately 28km and a catchment area of 239 km^2 (McGinnity *et al*, 2003). Upstream of the discharge point, the catchment area of the River Nanny is approximately 200km^2. At this location, the river has a 50%ile and 95%ile flow of 1.91m^3/s and 0.323m^3/s respectively (EPA Hydrometric data system).

The River Nanny has a long history of pollution; mainly from agricultural sources (McGarrigle *et al*, 2004). In Appendix 2, a summary of water quality in the River Nanny along with overall water quality in Hydrometric Area 8 during the most recently published EPA survey is presented.

The entire River Nanny was in an unsatisfactory ecological condition when most recently monitored by the EPA in September 2014 (source EPA website). The stations at Folistown (0400) and the east Bridge at Kentstown (0110) were both rated 'Moderately Polluted (Q3)', equivalent to Water Framework Directive (WFD) 'poor status'. The nearest EPA biological monitoring station upstream of the Irish Cement discharge is at the Bridge NE of Bellewstown House (station 0500). In 2014, this part of the river was rated 'Slightly polluted (Q3-4)' corresponding to WFD 'moderate status'. The nearest EPA biological monitoring station downstream of the discharge point is at Beaumont Bridge (0600). The River Nanny was rated ''Moderately Polluted (Q3)' by the EPA at Beaumont Bridge in 2016.

The River Nanny is in the Eastern River Basin District and is within the Nanny Water Management Unit (WMU) where the land use is predominantly agricultural (ERBD, 2009). A Water Management Unit (WMU) is a geographic area primarily defined by similar hydrology and topography.

2. METHODS

2.1 Site location

The locations of the six study sites (Site N1 to N6) are given in Table 1 and Figure 1. The location of the discharge from the Irish Cement plant is also indicated in Figure 1. Site photographs are provided in Plates 1 to 6. The sites surveyed are at the same locations as in previous assessments (i.e. Ecofact, 2008 - Ecofact, 2015). The sampling location for the Irish Cement discharge was located at the outfall point to the Nanny River.

Table 1 Location of six biological and sediment sampling sites.

Site	N1	N2	N3	N4	N5	N6
Habitat Category	Riffle	Glide	Pool	Pool	Glide	Riffle
Sample type	Receptor	Receptor	Receptor	Reference	Reference	Reference
Location	Downstream of outfall	Downstream of outfall	Downstream of outfall	Upstream of outfall	Upstream of outfall	Upstream of outfall
NOS Grid Reference	O07976 69254	O07865 69186	O07783 69171	O07589 69186	O07537 69165	O07349 69166

2.1 Biological Assessments

2.1.1 Macroinvertebrate sampling

Semi-quantitative sampling of benthic macroinvertebrates was undertaken at the six sites listed using kick or sweep sampling (Toner *et al*, 2005). Sampling was undertaken on the 4th and 5th of June 2015. A total of three sites were located within a 0.5 km section of river extending upstream of the Irish Cement discharge point (reference sites), and three sites were located over a similar distance downstream (receptor sites). Representative riffle, glide and pool habitats (EA, 2003) were sampled at both reference and receptor locations. Site 1 was located downstream of an old mill weir while site N2 was located upstream of this impoundment. The presence of this weir on the section can be expected to influence local sedimentation rates.

The biological sampling procedure followed at each site involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken over a further 1-minute period to ensure a representative sample of the fauna present at each site was collected.

All three samples of invertebrates from each substation were combined and live sorted on the river bank for 20 minutes with the assistance of a headband magnifier. Specimens were fixed in a 10% formalin solution. Identification was undertaken in the laboratory using high-power and low-power binocular microscopes. All collected samples have been archived and will be retained for 1 year.

2.1.2 Biotic Indices

2.1.2.1 The Quality Rating (Q) System

The Quality Rating (Q) System (Toner *et al*, 2005) is the standard biotic index which is used by the EPA. This method categorises invertebrates into one of five groups, depending on their sensitivity to pollution. Further details on the Q-rating system and its relationship to the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) are provided in Appendix 1.

2.1.2.2 BMWP (Biological Monitoring Working Party) Score

In the revised BMWP scheme (Walley and Hawkes, 1997) biotic index of water quality, each family recorded in the sample is assigned a habitat specific score. This score depends on the pollution sensitivity of the invertebrate family together with the characteristics of the site where the invertebrates were found. A site is classed as one of the following depending on substrate type: riffle (>= 70% boulders and pebbles), pool (>= 70% sand and silt) or riffle/pool (the remainder). The BMWP score is the sum of the individual scores of the families recorded at each site - a family scores if present. A higher BMWP score is considered to reflect a better water quality and a score over 100 is indicative of very good water quality.

2.1.2.3 Trent Biotic Index

The Trent Biotic Index (Woodiwiss, 1960) is based on the number of defined taxa of benthic invertebrates in relation to the presence of six key organisms found in the fauna of the sample site. Depending on the number of taxonomic groups present and the key organisms found in the fauna, the TBI index ranges from fifteen for clean water, to zero for polluted water.

2.1.2.4 Chandler Biotic Score

The Chandler Biotic Score (Chandler, 1970) also assigns values to taxonomic groups ranked in terms of pollution sensitivity but, in addition, provides scores for each species which is present in the taxonomic groups. This is a more powerful, albeit more taxonomically demanding, system than the previous biotic indices. Each group is given a score according to its abundance. The total score represents the index and the higher the score the cleaner the water.

2.1.3 Functional Group Analyses

Functional Group analysis is a classification technique for stream macroinvertebrates which involves the functional analysis of invertebrate feeding, based on morpho-behavioural mechanisms of food acquisition. A number of functional feeding groups of invertebrates occur in streams. These are Shredders, Collectors (or filterers), Scrapers (or grazers), and Predators. Shredders chew, mine, bore and gouge large particles such as leaves, sterns and branches which may be dead or alive. Filterers filter particulate matter, alive or dead, from the water. Collectors again feed on small particulate matter but gather the fine detritus off the sediment or other surfaces rather than from the open water. Grazers graze and scrape the periphyton off other surfaces. Predators are subdivided into engulfers, which eat the whole prey item swallowing it whole or by chewing, and piercers, which pierce the prey and suck fluids out. Food sources vary along the length of a river. Narrow upland streams, for example, rely heavily on allochthonous leaf debris (known as CPOM or Coarse Particulate Organic Matter) which can be used by shredders. In downstream areas, the fine debris of demolished leaves (fine particulate organic matter, FPOM) will support collectors. Changes in functional groups reflect changes in food sources, nutrient processing and energy flow in the river system. Human influences on a river can dramatically alter food sources and in turn affect the trophic groups. This method of analyses was therefore used as it provides a high resolution insight into the ecology of a river and has the ability to detect more subtle changes in community structure than would be apparent from biotic indices. Some of the mayfly larvae recorded exhibit dual feeding strategies (scrapers and collector gatherers). In the functional group analysis, where this occurred 50% of mayfly larvae were categorized as scrapers and 50% as collector gatherers.

2.1 Sediment and Water Sampling

A sediment sample was obtained for analyses at each of the six sites using a large trowel. Three sub-samples were taken and combined into a composite sample for each site. Each sub-sample was taken from undisturbed relatively homogeneous sediment deposits at the site. Each sample was placed into a mixing bowl and objects such as sticks and leaves etc. were removed as necessary. The sample was then stirred thoroughly with a mixing spoon to homogenize. The sample was then placed into a labelled container.

A water sample of the effluent was taken on the 24thJune 2015. The water sample was analysed for Total Hydrocarbons, Heavy Metals and Petroleum Range Organics. BOD (Biochemical Oxygen Demand) and

Total Hardness were analysed in samples taken from Sites N1 and N6. Samples were labeled and placed in a cooler box and were promptly delivered to the laboratory by courier. During sampling appropriate measures to prevent contamination from other sources was undertaken and all sampling equipment had been thoroughly cleaned.

2.2 Eco-toxicology testing

Condition 6.14.4 of the IPPC license requires toxicological testing to be carried out on the two most sensitive species tested in 2010. The species chosen for toxicity resting was a freshwater crustacean *Daphnia magna* which was subject to an immobilization test and a bioluminescent bacteria *Vibrio fischeri* in a Microtox - light inhibition test.

Toxic pollutants can be described in terms of acute and chronic toxicity. Acute toxicity is when a large dose of pollutant is released in a short period of time whereas chronic toxicity is a low dose of pollutant released over a long period of time, the former having more of a lethal effect on the biota of the receiving water. Chronic toxicity can be lethal or sub-lethal and can result in the mal-functioning of organisms by impairing biochemical, physiological, behavioral or life-cycle functions. When toxic pollutants enter the aquatic environment they may be altered by influences such as temperature, the quality of the water, pH and hardness. It is well known that temperature influences the metabolic activity and behavior of organisms however it can also alter the physical and chemical state of pollutants. For some toxicants, increasing temperature results in increasing toxicity of the pollutant.

Toxic contaminants are rarely individual chemicals, effluents or metals; more often than not they are mixture of poisons. When two or more pollutants are present in an effluent they may exert a combined effect on an organism which is said to be *additive*, the contaminants may also interfere with one another, an antagonistic effect or the overall effect of the pollutant on an organism maybe greater than when acting alone, a synergism effect (Mason, 2002). In order to minimize the effects of pollutants on the environment toxicity tests have been developed to assess the toxicity of an effluent and to predict, in conjunction with other information e.g. available dilution, chemical characterisation, the impact it will have on the receiving waterbody. The receiving waterbody dictates the selection of the test organisms. The receiving waterbody is freshwater. Toxicity testing is essentially for environmental protection of an area, to control the wastes from animal residues and humans, to monitor industrial and manufacturing processes in order to issue discharge licences, for legal and ethical issues i.e. to protect biota in aquatic ecosystems.

A sample of the discharge from the Irish Cement plant was taken on the 24th June 2016. The sample consisted of 1 litre and was taken from outfall at the River Nanny approximately 100m south of the R150 (O07712 69161). The sample of the discharge was placed in a cooler box. The sample was transported to the Aquatic Services Unit of the Environmental Research Institute (ASU), Lee Road, Cork where toxicology tests were carried out on the sample. This is a specialised facility for culturing and testing aquatic organism which has been accredited for *Daphnia* and Microtox testing. The tests carried out were as follows:

- 48 h EC_{50} to *Daphnia magna*
- 15,30 min EC_{50} to *Vibrio fischeri*

The methodology used for each of the above tests followed the "Organization for Economic Co-operation and Development (OECD) guidelines for testing of chemicals". Data from each test was used to screen for toxicity i.e. to determine if the effluent was toxic. Each test is discussed separately below. In each test a concentration series is set up where the test organism is placed in 100%, 56%, 32%, 18%, and 10% neat effluent. A control is set up; for *Daphnia* potassium dichromate is a reference chemical and for the bacteria *Vibrio fischeri*, the metal zinc sulphate is commonly used. Exposure times are pre-determined depending on the species being tested. Further details of each test are provided below.

The objectives of toxicity tests were to:

1. Assess the toxicity and lethality of compounds i.e. to what extent are the compounds hazardous to the environment, to humans, to animals etc;
2. To test the effects of environmental factors on waste toxicity i.e. temperature, pH, salinity, water hardness;
3. To investigate trophic mobility i.e. how do compounds move up through the ecosystem; and
4. To test the toxicity of a waste to a test species i.e. at each trophic level a test species is investigated e.g. a primary producer, primary consumer and secondary consumer.

2.2.1 Daphnia magna Bioassay

The *Daphnia* bioassay was carried out following standard methods as described in UK Environment Agency guidelines (2007). The effluent was tested for toxicity at the following concentrations 6.25, 12.5, 25, 50, and 100%. Twenty *Daphnia* neonates (animals less than 24 hours old) were tested for each concentration. These animals were added into 4 replicates of five animals per test chamber for each concentration. A concurrent reference toxicant bioassay was also carried out to determine the health and suitability of the organisms. Testing was carried out in a constant temperature room at a temperature of 20ºC ± 2 throughout the test. A light regime of 16 hours light / 8 hours dark was used throughout the testing period. The test duration was 48 hours. Reconstituted water made from 2 parts Ballygowan mineral water and 3 parts distilled water was used as control and dilution water. The *D. magna* were obtained from in house cultures at ASU.

2.2.2 Vibrio fischeri bacteria bioassay using Microtox system

This test involves using the marine bacteria *Vibrio fischeri*. The luminescent bacteria *Vibrio fischeri* are used exclusively in the Microtox system. Testing was carried out following the Azur Environmental guidelines for a Basic Test (Azur Environmental, 1995). The concentrations of effluent tested ranged from 2.5% to 81.9%. Two replicates were used for each concentration tested. A concurrent reference toxicant bioassay was also carried out to determine the health and suitability of the bacteria.

2.2.3 Statistical Analyses

Statistical analyses to generate LC50 (Lethal Concentration to cause 50 percent mortality) or EC50 (Effective Concentration to cause 50 percent effect) data were performed using the ToxCalc v5.0.32 Environmental Toxicity Data Analysis System, (Tidepool Scientific 2007). Statistical analyses on the Microtox Data were performed using the proprietary Microtox Omni software (Azur Environmental 1995).

2.3 Habitat Survey

Physical habitat assessments were undertaken at the six biological sampling sites. Habitat has a key influence on the macroinvertebrate communities, which occur in rivers and streams. The physical habitats of study sites were assessed in relation to macroinvertebrates using a method given by Barbour and Stribling (1991). This method assesses habitat parameters and rates each parameter as optimal, sub-optimal, marginal or poor (scores 5, 10, 15 and 20 respectively). The scores for each parameter are then added up to give an overall habitat score.

2.4 Other WQ parameters

During the current survey Conductivity (µs cm^{-1}), water temperature (^{o}C), and Dissolved Oxygen (mgl^{-1} and % saturation) were measured using on-site using portable meters. These parameters, along with salinity and pH were also measured in the water sample provided to ASU for eco-toxicology testing.

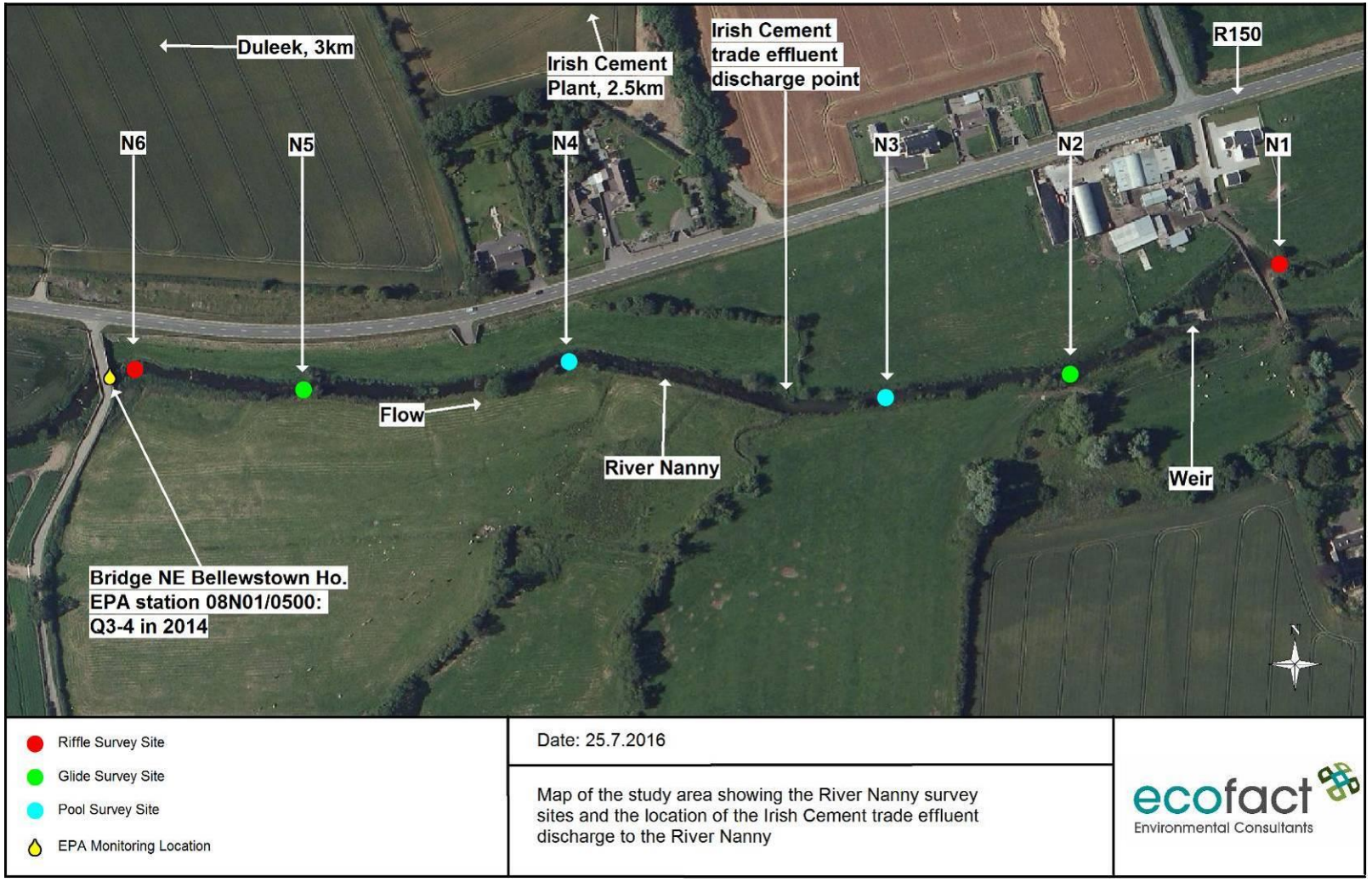


Figure 1 Map of the study area showing the location of the Irish Cement outfall to the River Nanny and river survey site.

3 RESULTS AND DISCUSSION

3.1 Physical Habitat

The physical habitat characteristics of the six sites assessed during the June 2016 survey are presented in Table 2. The physical habitat assessment of the six sites with respect to their suitability for macroinvertebrate production is presented in Table 3. All sites were rated as being sub-optimal for macro-invertebrate production with generally marginal pool quality, habitat complexity and canopy cover. Siltation in the surveyed stretch of river continues to be a problem despite the unusually wet summer brought about by the high rainfall levels. In the past, the EPA has indicated that land disturbance (such as ploughing) could possibly be a cause of siltation in the river. Indeed, a large proportion of lands in the study area are used for crops such as potatoes and grains which require ground preparation and exposing bare soil, with potential for suspended solids runoff.

Table 2 Physical characteristics at the six sampling sites.

Parameter	N1	N2	N3	N4	N5	N6
Habitat Category	Riffle	Glide	Pool	Pool	Glide	Riffle
Sample type	Receptor	Receptor	Receptor	Reference	Reference	Reference
Wetted width (m)	5	7	7	6	7	6
Bank height (cm)	130	100	100	100	150	50
Bank cover (%)	95	95	100	100	95	100
Bank slope (degrees)	50	65	70	80	65	40
Canopy cover (%)	10	5	5	5	0	0
Flow (cm/s)	25	5	0	0	5	30
Riffle (%)	35	0	0	0	0	35
Glide (%)	45	10	0	0	20	35
Pool (%)	45	90	100	100	70	30
Mean depth (cm)	25	95	70	85	70	45
Maximum depth (cm)	60	120	100	100	110	75
Rock (%)	20	20	40	20	25	5
Cobble (%)	30	40	25	15	25	15
Gravel (%)	20	15	15	15	20	60
Fine (%)	30	25	20	50	30	20
In-stream vegetation (%)	25	25	35	25	15	25

Table 3 Physical habitat assessment of the six sites for their suitability for macroinvertebrate production (adapted from Barbour and Stribling, 1991).

Site Habitat Category Sample type	N1 Riffle Receptor	N2 Glide Receptor	N3 Pool Receptor	N4 Pool Reference	N5 Glide Reference	N6 Riffle Reference
Bottom substrate	10	5	5	5	5	10
Habitat complexity	15	10	10	10	10	15
Pool quality	5	5	5	5	5	5
Bank stability	15	15	20	20	15	20
Bank protection	15	15	20	20	15	20
Canopy	10	10	10	10	10	5
Score	**70**	**60**	**70**	**70**	**60**	**75**
Overall Assessment	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**	**Suboptimal**

3.2 Temperature, Conductivity, Dissolved Oxygen and other WQ parameters

3.2.1 Results of the on-site assessments

On-site water quality assessments were carried out on the 23rd and 24th of June 2016 at the six sites sampled on the River Nanny. The six D.O. readings were taken from downstream to upstream within 35 minutes beginning at 10.15. Dissolved Oxygen (D.O.) concentrations ranged from 80.5% saturation at Site N3 to 111.4% saturation at Site N6. The highest D.O. concentration downstream of the discharge was at Site N1 where riffled flow and shallow water with a mat of algal cover are thought to have strongly influenced oxygenation conditions. There was little disparity between D.O. in the River along the stretch from Site N2 to Site N4 where D.O. saturation was 8.26% at N2, 80.5% at N3 and 84% at N4. It is noted that the D.O. concentration in the discharge within this time interval was 99.2%. The greatest D.O. saturations were recorded at Sites N5 and N6 where readings of 106.8% and 111.4% were recorded respectively. Again, well aerated water at Site N6 is deemed to have affected D.O. saturation here.

Diurnal fluctuations in D.O. can be expected to occur naturally in rivers and the D.O. range is in indication of aerobic activity and Biochemical Oxygen Demand (B.O.D.). Conversely, the D.O. saturation decreases by night when sub-aquatic plants undergo cellular respiration. During the current survey, D.O. saturation was seen to increase considerably over 35 minutes. The difference in maxima and minima D.O. saturations in the current survey was 30.9%. This range of saturation is not unexpected given the presence of luxuriant filamentous algal growth recorded on the bed and within the water column of the river at all sites.

Filamentous algae is considered a primary driver of D.O. in the subject stretch if the River Nanny where underwater photosynthetic action of algae and other submerged plants is apparently excessive when light is available. In the EPA Q-rating scheme, a D.O. within the range 80%-120% is indicative of 'moderate status' conditions. Collective D.O. concentrations downstream and upstream of the discharge are indicative of unsatisfactory oxygenation conditions. A range in D.O. far greater than this can be expected in the river Nanny within the study area however i.e. much lower concentrations at dawn due to plant respiration and depleted D.O. and much higher concentrations in the evening following a long day of photosynthesis. Based on the on-site chemical results for Dissolved Oxygen, there was no evidence to suggest that the River Nanny was being negatively affected by the Irish Cement discharge.

Based on the on-site assessments, Conductivity in the river Nanny was in the range 403µS/cm - 437µS/cm. The mean conductivity at Site N1, N2 and N3 (downstream of the discharge) was 434µS/cm and the mean conductivity at Site N4, N5 and N6 (upstream of the discharge) was also 409µS/cm while the Conductivity of the discharge was 560µS/cm. Based on the results of the current assessment, it is considered that the discharge was having the effect of slightly increasing Conductivity in the River Nanny downstream of the discharge i.e. an increase of ca. 6%.

The water temperature variations across the six sites between 10.15 and 10.50 on the 24th June 2016 was minimal, ranging from 14.8°C to 15°C. The mean water temperature of the three sites downstream of the Irish Cement discharge was 14.83°C while the mean water temperature of the three sites upstream of the Irish Cement discharge was 14.86°C. The water temperature of the Irish Cement discharge to the River Nanny at 10:35 was 14.8°C. The effect of the discharge on the ambient temperature of the River Nanny at the time of the current survey was negligible.

Table 4 Results of the June 2016 on-site water quality assessments.

	Site N1	Site N2	Site N3	Site N4	Site N5	Site N6	Discharge
Temperature (^{o}C)	15	14.9	14.6	14.9	14.9	14.8	14.8
Dissolved Oxygen (%)	88.8	82.6	80.5	84.0	106.8	111.4	99.2
Dissolved Oxygen (mg O_2l^{-1})	8.96	8.24	8.16	8.41	10.77	11.27	10.01
Conductivity (µS cm^{-1})	435	430	437	409	416	403	560
Time	10.15	10.25	10.30	10.40	10.45	10.50	10.35

3.2.2 Laboratory results

In the Freshwater Fish Directive (79/923/EEC) and Salmonid Waters Regulations (1988) there are no recommended or mandatory limit values for Hydrocarbons. However, it is stated that Petroleum products must not be present (in water) in such quantities that they: - form a visible film on the surface of the water or form coatings on the beds of water-courses and lakes - impart a detectable 'hydrocarbon' taste to fish - produce harmful effects in fish. In this respect, the discharge was compliant as no slick was seen nor did it impair the water surface of the River Nanny following mixing. Appendix 3 presents laboratory result for the discharge sample taken on 24thJune 2016.

Water quality analysis assessed levels of potentially harmful chemical elements and Heavy Metals. These were the non-metals Arsenic <0.814µg/l and Selenium <3.57µg/l and Heavy Metals Chromium <4.02µg/l, Copper <0.919µg/l, Nickel <1.33µg/l, Lead 0.05µg/l, Zinc <0.41µg/l.

Total Petroleum Hydrocarbons and Mineral Oils in the discharge sample were both below the level of detection of 1mg/l.

BOD (Biochemical Oxygen Demand) and Total Hardness results from Sites N1 and N6 on the River Nanny. BOD downstream and upstream of the discharge was <1mg/l for both sites. Total hardness downstream (Site 1) and upstream (Site 6) of the discharge was 282mg/l and 302mg/l respectively.

Based on laboratory results for BOD, Hardness, Organic compounds Non-metal and Metal groups analysed, there was no evidence to suggest that the River Nanny was being negatively affected by the Irish Cement discharge. The overall results obtained are similar to the previous monitoring assessments.

3.3 Sediment PSD

The results of the PSD (particle size distribution) analyses of fine sediments sampled at the six survey sites are presented in Table 5. The bulk of the fine sediments sampled in the current study comprised sand and gravels. The generally fine particles in the samples indicate that the samples were taken from depositing areas. This is a requirement in determining the effect of the discharge on PSD in the river downstream of the discharge point, as it is fine particles in the discharge that could affect aquatic ecology in the River Nanny. The following interpretations of results for PSD are therefore focused on the smaller fraction of the sediment sample results.

The smallest particle category was very fine (silt/clay) of size 0.063mm or less. There was considerable variation in the silt/clay component of samples with a minimum quantity at Site N6 (2.1%) and the largest amount at N5 (27.4%). Overall, there was no evidence to suggest that there were greater quantities of finer particles in the subject stretch of the River Nanny downstream of the discharge. This observation is

based on the mean proportion of silt/clay at Sites N1, N2 and N3 of 8.3% measured against a mean of 11.3% with respect to Sites N4, N5 and N6. Indeed, a trend of smaller average quantities of finer particles at the receptor sites (N1, N2, and N3) compared to reference sites (N4, N5 and N6) was also observed for smaller sized sand particles i.e. those within the 0.125mm - 0.6mm.

At both Sites N1 and N6, there was a high and similar proportion of gravel. Smaller particle sizes of sand (<0.125mm – <1mm) and silt/clay (<0.63) were more frequent at reference Site N1 downstream of the discharge than at Site N6 upstream. At N2 and N5 there was a high degree of variation between the PSD for smaller particle sizes. The pool sites (N3 and N4) upstream and downstream of the discharge point were the most similar with respect to PSD.

The current PSD show noteworthy differences in fine substrate composition between samples taken upstream and downstream of the Irish Cement trade effluent discharge point. In particular, the component of the substrate most likely to be influenced by the discharge (i.e. the silt/clay fraction of samples) fluctuated between all sample sites but there was no trend to suggest that the proportion of fine particles increased downstream of the discharge point.

Table 5 Results of the Particle Size Distribution Analysis of fine sediments sampled at the six survey sites.

Category	Particle size (mm)	% Passing in each sample					
Habitat type Sample type		N1 Riffle Receptor	N2 Glide Receptor	N3 Pool Receptor	N4 Pool Reference	N5 Glide Reference	N6 Riffle Reference
Gravel	9.5	84.91	97.95	94.73	77.42	90.46	94.83
	5.6	71.68	92.04	78.46	60.36	80.80	86.02
Sand	4	64.74	85.45	69.36	53.07	74.69	79.78
	2	52.88	61.86	52.42	38.94	59.97	52.32
	1	36.40	30.06	32.78	24.18	44.91	21.91
	0.6	26.26	15.96	17.62	16.08	40.06	10.27
	0.250	17.07	8.01	5.31	6.09	34.32	2.42
	0.125	15.19	6.78	4.76	4.49	30.94	2.46
Silt/Clay	0.063	14.39	6.23	4.18	4.34	27.43	2.11

3.4 Macroinvertebrate Diversity and Abundance

Table 6 presents the results of the on-site macroinvertebrate survey at the six sites surveyed on the River Nanny during June 2015. Macroinvertebrate diversity and abundance at each of the six sampling sites is illustrated in Figure 2.

During the survey of the six sites, a total of 2622 macroinvertebrates comprising 26 families were identified. At the receptor sites a total of 1420 macroinvertebrates were collected while a total of 1202 macroinvertebrates were collected at the references sites. Family richness for the receptor sites combined was 23 in comparison with 24 at the references sites combined.

Macroinvertebrate family diversity at Site N1, the receptor riffled site was 20. Ephemeropterans recorded at this site were larval stage pollution tolerant *Baetis rhodani* (common) and *Ephemerella ignita* (scarce). Pollution tolerant *Gammarus duebeni* was the most abundant organism at this location. Molluscs recorded at this site were pollution tolerant *Bithynia tentaculata* and *Ancylus fluviatilis* with *Pisidium sp.* also common. Trichopterans (caddisflies) were represented by two cased (*Potamophylax* sp. and *Athripsodes cinereus*) and a single un-cased family (*Rhyacophila dorsalis*). The beetle *Elmis* sp. as well

as the aquatic earthworms (*Lumbricidae*) was also recorded among the macroinvertebrate assemblage at this site.

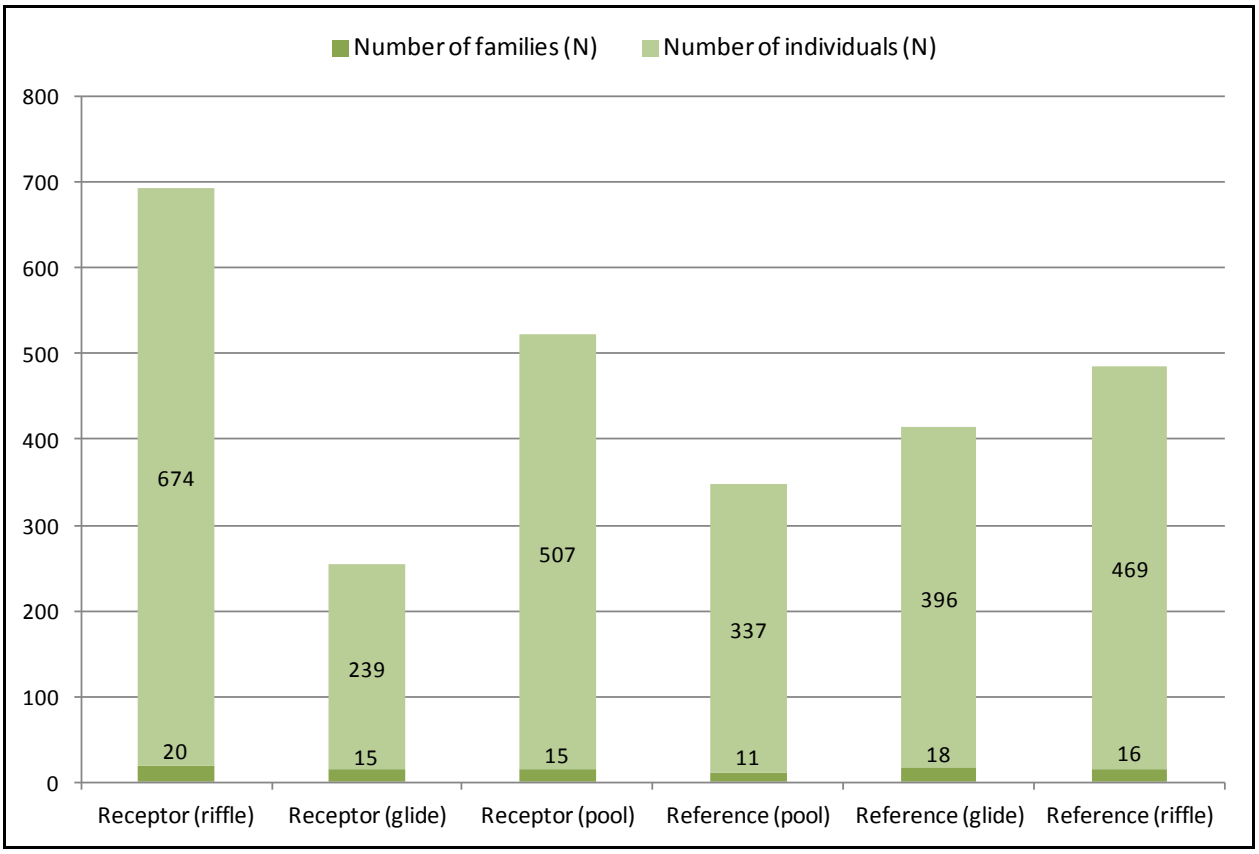


Figure 2 Macroinvertebrate diversity and abundance at each of the six sampling sites.

The receptor glide site (N2) had a family richness of 15. Ephemeropterans were represented by only one species the pollution tolerant larvae of *B. rhodani* (present). Four families of Trichopteran were recorded with larvae of the following species: *P. kingi*, Limnephilidae, and *R. dorsalis.* Dipteran larvae recorded at this location were *Chironomous* sp. and green chironomids. The only Mollus recorded at this site was *Bithynia tentaculata*. *Helephorus sp.* was the only Coelopteran recorded at this location. The most abundant macroinvertebrate was *G. duebeni*, the pollution intolerant Crustacea *Asellus aquaticus* was scarce at this site. The very tolerant leech *Erpobdella octoculata* and Alderfly larvae (Sialidae) were present. The bugs *Sigara dorsalis* and *Gerris* sp. were also recorded at this site.

A total of 15 macroinvertebrates families were recorded at the receptor pool site (N3). Ephemeropterans were represented by only one species, namely pollution tolerant larvae of *E. ignita*. Trichopterans were the most diverse order of macroinvertebrate at this site with cased caddisfly larvae in 3 families recorded (*Potamophylax sp., Hydroptilidae* and *Sericostoma personatum*) and 1 family of caseless caddisfly (*R. dorsalis*). Molluscs were also a well represented order at this site with pollution tolerant *Bithynia tentaculata (62)* and *Ancylus fluviatilis* occuring. The most abundant and numerous macroinvertebrate was the Crustacean *G. duebeni.* The pollution tolerant bugs *S. dorsalis and Gerris sp.* were also present. Alderfly larvae *Sialis* sp. was also recorded at N3. Three families of Diptera were represented in the

sample: *Simulidae, Chironomidae,* and *Chironomous* sp*.* The Leech *Erpobdella octoculata* was also present at this site*.*

A total of 11 macroinvertebrates families were recorded at the reference pool site (N4). Ephemeropterans were represented in fair numbers by only one species, the pollution tolerant larva of *E. ignita*. Trichopterans were also represented by only one species of cased caddisfly (*Potamophylax sp*.) The most abundant and numerous macroinvertebrate was *G. duebeni,* while very pollution tolerant *Asellus aquaticus* was also found. Damselfly larvae of the *Banded jewelwing Agrion splendens* was scarce*. Gerris sp.* of Hemiptera was present while the only Dipteran recorded was the scarce *Chironomous sp.* The beetles *Elmis* sp. and *Helephorus* sp. as well as the aquatic earthworm (*Lumbricidae)* were also recorded among macroinvertebrate assemblage at this site.

A total of 18 macroinvertebrates families were recorded at the reference glide site (N5). The sole Ephemeropteran representative was pollution tolerant larvae of *E. ignita*. Trichopterans were a well represented group at this site with 3 cased caddisfly families (*Potamophylax sp., A. cinereus, and S. personatum*) with caseless caddisfly larvae of *R. dorsalis* and *P. kingi* scarce. Fair numbers of the Molluscs *B. tentaculata,* and *Pisidium sp.* were recorded. The most abundant macroinvertebrate was *G. duebeni* which was dominant. The beetles *Haliplus* sp. and *P. depressus elegans* as well as the pollution intolerant bugs *S. dorsalis* were also present at this site. Pollution tolerant true fly larvae of the Simulidae were present at this site along with small numbers of very tolerant *Chironomous sp.*

Macroinvertebrates in 16 different families were recorded at the reference riffle site (N6). Mayfly larvae of *E*. *ignita* and *B. rhodani* were common. Trichopterans were represented by 2 cased caddisfly families which included the following species: *Potamophylax sp. and S. personatum.* Caseless caddisfly larvae of *H. siltali* and *R. dorsalis* were scarce. Three species of Mollusc were also present with *B. tentaculata* common here*. Pisidium sp* and *A. fluviatilis* also occurred. *G. duebeni* was the most numerous macroinvertebrate at this site (dominant) while the very pollution tolerant Crustacea *A. aquaticus* was also present at this site. The pollution tolerant Bug *S. dorsalis* and *Gerris sp.* were also recorded. The beetle *Elmis sp. was* present in scarce numbers while aquatic earthworms *Lumbricidae* and *A. splendens* were also recorded at this site.

The macroinvertebrates recorded during the current survey were typically those associated with polluted lowland Irish limestone rivers. Molluscs and crustaceans were the most abundant groups recorded, while Trichoptera (both cased and caseless) are also well represented. Crustacea, particularly *G. duebeni,* far outweighed any other group present.

Compared to 2015, there was a decrease in family richness at all sites with the exception Site (N6) where family richness remained at 20. There was however an increase in the number of individuals from 2015. There was no evidence however to suggest that the macroinvertebrate community of the River Nanny was being negatively affected by the Irish Cement discharge.

3.5 Biological Water Quality

The current survey was carried out during June 2016. The river was examined following an extended period of relatively dry weather. Water levels in the river were considered low for the time of year. The subject stretch of the River Nanny had the appearance of being organically enriched i.e. both upstream and downstream of the Irish Cement discharge. Excessive algal growth of *Cladophora* sp. was evident on

submerged aquatic vegetation, the riverbed, and also formed dense floating mats where water was backed up in front of stands of emergent vegetation. Filamentous alga was also seen growing from the bed of the river into the water column where conditions of low flow allowed. Macrophyte growth was of limited diversity (dominated by Common Club Rush *Schoeneoplectus lacustris* and Branched Bur-reed *Sparganium erectum* with Reed Canary grass *Phalaris arundinacea* along banks) and growth of these plants was excessive. In addition, underwater features visible at the time of the survey were seen to have a considerable coat of deposited silt. These factors are usually associated with unsatisfactory biological water quality and also have the effect of reducing habitat quality for aquatic macroinvertebrates. Figure 3 shows the biotic index survey results for the six aquatic sites surveyed on the River Nanny in June 2015. The ensuing biological water quality results are based on kick sampling carried out on the three sites downstream of the Irish Cement discharge point (N1, N2 and N3) and three sites upstream of same (N4, N5 and N6).

Table 6 Results of the on-site macroinvertebrate survey at the six survey sites on the River Nanny during June 2016.

Habitat Category **Sample type**	**Pollution sensitivity group**	**Functional group**	**Site N1** Riffle receptor	**Site N2** Glide receptor	**Site N3** Pool receptor	**Site N4** Pool reference	**Site N5** Glide reference	**Site N6** Riffle reference
SEGMENTED WORMS (Annelida, Clitellata)								
Aquatic earthworm (Lumbricidae)	D	Gathering collector	2			2	1	2
LEECHES (Hirudinea)								
Erpobdellidae								
Erpobdella octoculata	D	Predator		1	1		1	
SNAILS (Mollusca, Gastropoda)								
Ancylidae								
River limpet *Ancylus fluviatilis*	C	Scraper	22		6			9
Family Hydrobiidae								
Common Bithynia *Bithynia tentaculata*	C	Shredder	2	19	62	18	23	10
MUSSELS (Mollucsa, Lamellibranchiata)								
Orb/ Pea Mussels (Sphaeridae)								
Pisidium sp.	D	Filtering collector	42				5	2
CRUSTACEANS (Crustacea)								
Amphipods (Amphipoda, Gammaridae)								
Freshwater shrimp *Gammarus duebeni*	C	Shredder	280	155	310	250	285	290
Isopods (Isopoda, Asellidae)								
Hog louse *Asellus aquaticus*	D	Shredder	22	4	25	12	13	2
MAYFLIES (Uniramia, (Ephemeroptera)								
Baetidae								
Baetis rhodani	C	Gathering collector	47	3				65
Empherellidae								
Empherella ignita	C	Gathering collector	6		1	38	19	26
CASELESS CADDIS FLIES (Trichoptera)								

Habitat Category Sample type	Pollution sensitivity group	Functional group	Site N1 Riffle receptor	Site N2 Glide receptor	Site N3 Pool receptor	Site N4 Pool reference	Site N5 Glide reference	Site N6 Riffle reference
Grey flags (Hydropsychidae)								
Hydropsyche siltalai	C	Filtering collector						3
Trumpet-net Caddisflies (Polycentropodidae)								
Polycentropus kingi	C	Filtering collector		1			1	
Rhyacophilidae								
Rhyacophila dorsalis	C	Predator	20	3	3		2	17
CASED CADDIS FLIES (Tricoptera)								
Sericostomatidae								
Black caperer *Sericostoma personatum*	B	Shredder			1		1	3
Limnephilidae								
Potamophylax sp.	B	Shredder	38	2	5	1	12	15
Microcaddisflies (Hydroptilidae)	B	Scraper			4			
Leptoceridae								
Athripsodes cinereus	B	Shredder	5				2	
DAMSELFLIES (Odonata, Zygoptera)	B	Predator						
Jewelwings/Demoiselles (Calopterygidae)								
Banded jewelwing *Agrion splendens*	C	Filtering collector	1	2	5	3	3	5
TRUE FLIES (Diptera)								
Blackfly larvae (Simulidae)	C	Filtering collector	120		3		6	
Chironomidae								
Green chironomid	C	Filtering collector	35	17	24			
Chironomous sp.	E	Filtering collector	10	4	6	5	16	
BEETLES (Coleoptera)								
Riffle beetles (Elmidae)								
Elmis sp.	C	Predator	5			2		14
Diving beetles (Dytiscidae)								
Sub family Hydroporinae								
Potamonectes depressus elegans	C	Predator	2				2	
Hydrophillidae								
Helephorus sp.	C	Predator	6	5		4		
Haliplidae								
Haliplus sp.	C	Predator					1	
BUGS (Hemiptera)								
Corixidae								
Sigara dorsalis	C	Predator	4	15	15		3	2
Gerridae								
Gerris sp.	C	Predator	5	2	33	2		4
MEGALOPTERA								
Alderfly larvae (Sialidae)	D	Predator		6	3			
Family Diversity			**20**	**15**	**15**	**11**	**18**	**16**
Total macroinvertebrate count			**674**	**239**	**507**	**337**	**396**	**469**

Macroinvertebrate family diversity is a metric for biological water quality. The greatest macroinvertebrate family diversity was recorded at the receptor riffle (Site N1) where a total of 20 families were recorded. In

comparison, a family richness of 16 was recorded at the reference riffle site (N6). The family richness at receptor glide and pool Sites N2 and N3 was 15. The family richness at reference pool and glide Sites N4 and N5 was 11 and 18 respectively. The mean family richness at the receptor and reference sites combined was 16.7 and 15 in that order. It is noted that higher species richness values, linked to family richness are mostly associated with cleaner water conditions. The results obtained for family richness indicate that the discharge is not having a significant influence on the macroinvertebrate diversity in the surveyed stretch of the river.

Biotic indices have been derived based on the macroinvertebrate communities found at each site. The biological water quality evaluations for the six survey sites on the River Nanny are given in Table 7. All the sites were rated 'Slightly Polluted (Q3)' using the EPA Q-rating system (Toner *et al.* 2005), equivalent to Water Framework Directive (WFD) 'Poor' status. This rating was brought about by the absence of pollution sensitive Plecopteran and mayfly larvae and the unstable oxygen levels. During the current round of surveying no pollution sensitive species were recorded. Group B larvae of cased caddisfly and damselfly were recorded at all survey locations. Pollution tolerant Molluscs and crustaceans accounted for the bulk of the macroinvertebrate assemblages. The riffled locations are probably the best sites on which to make an assessment of biological water quality as these areas, owing to fast flowing water and better habitat are most likely to support pollution sensitive indicators. Since the 2014 study, the Q-ratings for all sites have remained the same (Q3 - 'Moderately polluted') indicating that there has been no deterioration or improvement in water quality with respect to the EPA freshwater biological monitoring system.

The overall classification of macroinvertebrate species present at the receptor and reference sites in terms of their pollution sensitivity is given in Figure 4 and Table 8. Group 'C' pollution tolerant indicators comprised the bulk of the macroinvertebrate communities downstream (88% collectively at receptor sites) and upstream (91% collectively at reference sites) of the discharge point. The relative abundance of Group C indicators closely corresponds to the 2014 and 2015 results. Comparing the receptor and reference sites currently examined, there is also close correspondence between pollution sensitivity Group 'A' (0%, 0%), Group 'B' (4%, 4%), Group 'D' (7%, 3%) and Group 'E' (1%, 2%) where percentages in parenthesis are for receptor and reference sites correspondingly.

Comparing Site N1 and Site N6, it can be seen that there is little difference in the relative abundance of Group C indicators, N1 and N6 containing 82% and 94% pollution tolerant taxa respectively. Group B (less sensitive) indicators accounted for only 7% of the assemblage at Site N1 showing correspondence to Site N6 where this group accounted for 5% of the community. Very tolerant indicators (Group D) accounted for 10% of macroinvertebrates at Site N1 and 1% at Site N6. There was little variation in the macroinvertebrate compositions at corresponding glide sites in terms of pollution sensitivity groups.

The amount of Group C indicators at Sites N2 and N5 was 84% and 86% respectively. Group B indicators accounted for 2% of the assemblage at N2 downstream of the discharge and 5% at N5 upstream. A small proportion of the macroinvertebrates at these locations consisted of the most tolerant (Group E) indicators; 2% at Site N2 and 4% at Site N5. Likewise, there was little difference in the relative abundance of Group D indicators at Sites N2 and N5, these very tolerant indicators accounting for 7% and 5% of the macroinvertebrates assemblage at these locations, in that order. The macroinvertebrate assemblages at the pool Sites N3 and N4 was comprised of 84% and 93% Group C indicators, 10% and 4% group D indicators, and 3% and 1% Group B indicators respectively, with no pollution sensitive species recorded

at either site. These results closely reflect the results of the two previous surveys and indicate very similar biotic compositions in the River Nanny upstream and downstream of the Irish Cement discharge point.

Figure 5 illustrates the Biological Monitoring Working Party (BMWP), Trent biotic index and Chandler biotic index scores at the six survey sites. All the BMWP scores were less than 100 which are indicative of unsatisfactory water quality. The reduced BMWP scores coincided with observations of filamentous algal growth and siltation along the surveyed stretch of the river. BMWP scores are proportional to family diversity and the highest score of 94.9 was attained at Site N1, corresponding to 'good'/'clean but slightly impacted' conditions using BMWP interpretation. It is noted however that macroinvertebrate assemblages in lowland limestone rivers area usually high sometimes even in polluted circumstances and that this interpretation macroinvertebrate diversity may be misleading. The BMWP scores at the reference glide and riffled sites N5 and N6 and at the receptor pool sites were 88 and 82.1 and 80.1 respectively, so water quality at these locations is also categorised as 'good'/'clean but slightly impacted'. Site N2 and N4 downstream and upstream of the discharge point scored 64.9 and 53.1 in that order. Based on these scores, biological water quality at these locations is rated 'moderate'.

The Average Score per Taxon (ASPT) which is a function of the BMWP score is deemed to more accurately gauge water quality. An ASPT of more than 5.5 is thought to reflect good water quality. Two of the sites (N5 and N6) recorded an ASPT score of 5.5 but none were higher than this threshold figure. Sites N1 and N3 scored 5.3 and the lowest ASPT was 4.8 for Site N4. Overall, analyzing the BMWP scores over the study area does not point to a significant decrease in water quality at Sites N1, N2 and N3 with reference to Sites N4, N5 and N6. The Trent biotic index scores for the survey sites ranged from 6 to 8, with the reference pool site (N4) recording the lowest score of 6. Scores of 8 were attained at Sites N1 and N5 downstream and upstream of the discharge respectively. Again, as for the BMWP index, there was no significant decline in water quality downstream of the discharge point. Overall, the subject stretch of river does not fare well based on the Trent index where the maximum score of 15 shows the study sites to be in the region of mid range with regard to water quality.

Table 7 Biological water quality at the six survey sites on the River Nanny during June 2015.

Site and habitat category Site type	Site N1 Riffle Receptor	Site N2 Glide Receptor	Site N3 Pool Receptor	Site N4 Pool Reference	Site N5 Glide Reference	Site N6 Riffle Reference
Number of Families	20	15	15	11	18	16
Q-Value	Q3	Q3	Q3	Q3	Q3	Q3
Q-Status	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted	Moderately polluted
WFD status	Poor	Poor	Poor	Poor	Poor	Poor
BMWP score	94.9	64.9	80.1	53.1	88	82.1
BMWP category	Good	Moderate	Good	Moderate	Good	Good
BMWP interpretation	Clean but slightly impacted	Moderately impacted	Clean but slightly impacted	Moderately impacted	Clean but slightly impacted	Clean but slightly impacted
ASPT	5.3	5.0	5.3	4.8	5.5	5.5
Trent Biotic Index	8	7	7	6	8	7
Trent taxonomic groups	17	13	15	10	16	13
Chandler score	889	608	761	410	775	719
Chandler Biotic Index (average value)	47	41	48	41	46	48

There was very little difference in Chandler scores across the suite of sites surveyed. Chandler average values varied from 41 at Sites N2 and N4 to 48 at Sites N3 and N6. The ideal Chandler index value of 80 or more indicates an unpolluted, fast-running and well-aerated watercourse. The Chandler scores during the current assessment fall well short of 80, due to the absence of pollution sensitive taxa such as specific stonefly and mayfly larvae. Again, the Chandler scores do not indicate degradation in biological water quality downstream of the discharge point.

There was no discernible difference in water quality between the sites upstream and downstream of the Irish Cement discharge. Overall, the results confirm that biological water quality in the River Nanny is the same upstream and downstream of the Irish Cement discharge. The general trend was that the reference glide (N5) and receptor riffle (N1) scored higher than other sites due to greater family diversity. Compared to 2014 and 2015, there has been no significant change in biological water quality in the surveyed stretch of river i.e. both upstream and downstream of the discharge location. Based on the relative abundance of macroinvertebrate and biotic indices, it is considered that the River Nanny continues to be under considerable ecological pressure as signified by the absence of pollution sensitive indicators, low relative abundance of Group B indicators and domination by pollution tolerant taxa. As observed from year to year in previous surveys, the macroinvertebrate community in the surveyed stretch of river is variable, indicating ecological instability brought about apparently by pressures in the catchment.

Table 8 Classification of macroinvertebrate species recorded at each site in terms of their pollution sensitivity (EPA methods).

Site	Abundance	Pollution indicator group					
		Group A (Most sensitive)	Group B (Less Sensitive)	Group C (Tolerant)	Group D (Very Tolerant)	Group E (Most Tolerant)	Total
1	Number	0	44	554	66	10	674
	% of total	0	7	82	10	1	100
2	Number	0	4	220	11	4	239
	% of total	0	2	92	5	2	100
3	Number	0	15	457	29	6	507
	% of total	0	3	84	10	1	100
4	Number	0	4	314	14	5	337
	% of total	0	1	93	4	1	100
5	Number	0	18	342	20	16	396
	% of total	0	5	86	5	4	100
6	Number	0	23	440	6	0	469
	% of total	0	5	94	1	0	100

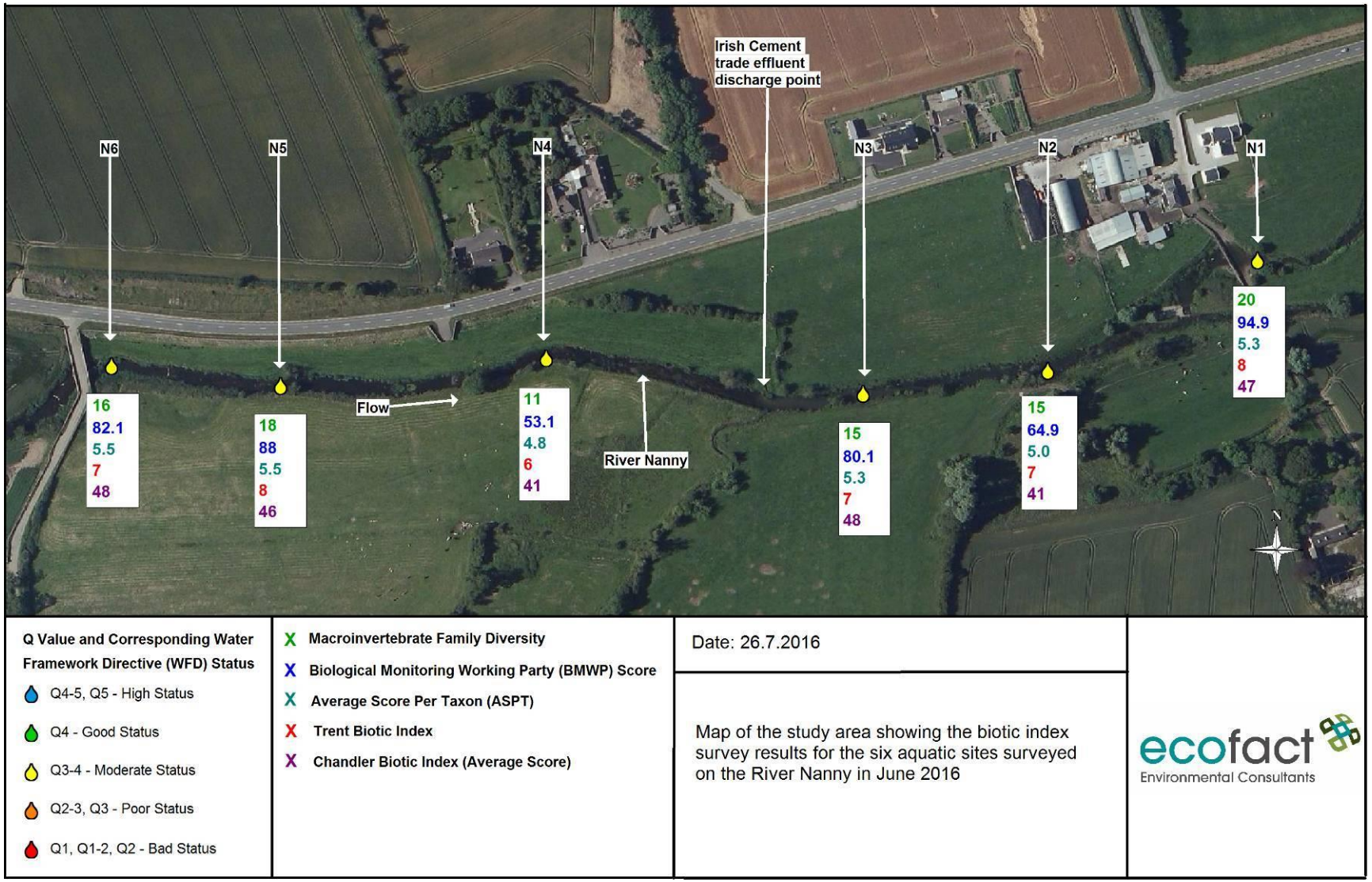


Figure 3 Map of the study area showing the biotic index survey results for the six aquatic sites surveyed on the River Nanny in June 2015.

3.6 Functional Groups

Detail on the macroinvertebrate functional groups recorded at each site is provided in Table 9. The dominant FFG for each site along with the P/R ratio for each site is provided in Table 10. The collective compositions of macroinvertebrate Functional Feeding Groups (FFG) at the receptor sites and reference sites is presented in Figure 6. The dominant FFG at the receptor sites was shredders. Shredders are a feeding category of macroinvertebrate that specialise in shredding organic matter into finer particles. Filtering collectors accounted for 18% of the macroinvertebrate assemblage at the receptor sites (N1, N2, and N3) and 3% at the reference sites (N4, N5, N6). There was some difference between the abundance of predators with 10% predators at the receptor and 5% predators at the reference sites. Gathering collectors represented 4% and 13% of macroinvertebrates recorded at receptor and reference sites in that order. Similarly, there was close correspondence between the relative abundance of scrapers; 2% and 1% at the receptor and reference sites respectively.

The relative abundance of gathering collectors recorded in the current study has also decreased from 7% to 4% at the receptor sites and increased from 4% to 13% at the reference sites. This decline would indicate a decrease in the availability of the fine detritus downstream of the discharge from 2015. The relative quantity of Shredders has also decreased at the receptor sites (70– 66%) however increased at the reference sites (71% to 78%). As shredders feed on decaying organic material (such as leaves/woody material) this would suggest a very minor increase of organic material downstream of the discharge compared to 2015.

A low occurrence of scrapers was recorded during the current survey field work. Water carrying a heavy suspended solids load or other factors that reduce light penetration and hence primary in stream production upon which scrapers depend dictate the abundance of scrapers in the aquatic ecosystem. Thereby, a decrease in primary production such as reduced diatom abundance would be expected to decrease the numbers of scrapers. Increased particulate organic matter washed into the river during rainfall events would support shredders and the relative abundance of this group would be expected to increase as observed in the current study. The relative abundance of scrapers in the current survey has remained the same as 2015, with neither an increase nor a decrease of numbers.

The most frequently occurring shredders were *Gammarus duebeni* and *Bithynia tentaculata. G. duebeni* was the most abundant macroinvertebrate recorded at all the sites by a considerable margin. *B. tentaculata* and *A. aquaticus* were also relatively abundant in the slower flowing parts of the river (N2-N5). The relative abundance of shredders was broadly comparable at corresponding receptor and reference sites. At the pool sites for example, there was 79% shredders at N3 and 83% shredders at N4. There was some variation at the riffle sites in which shredders comprised of 51% (N1) and 68% (N6) of the assemblage at the receptor and reference sites in that order.

Comparing the percentages of predators at the receptor sites and corresponding reference site, there was 6% at N1 and 9% at N6 (riffles); 14% at N2 and 3% at N5 (glides); and 12% at N3 and 3% at N4 (pools). The dominant predators were the bugs *Gerris* sp., and *Sigara dorsalis*. The leech *Erpobdella octoculata* was also recorded at Sites N2, N3 and N5.

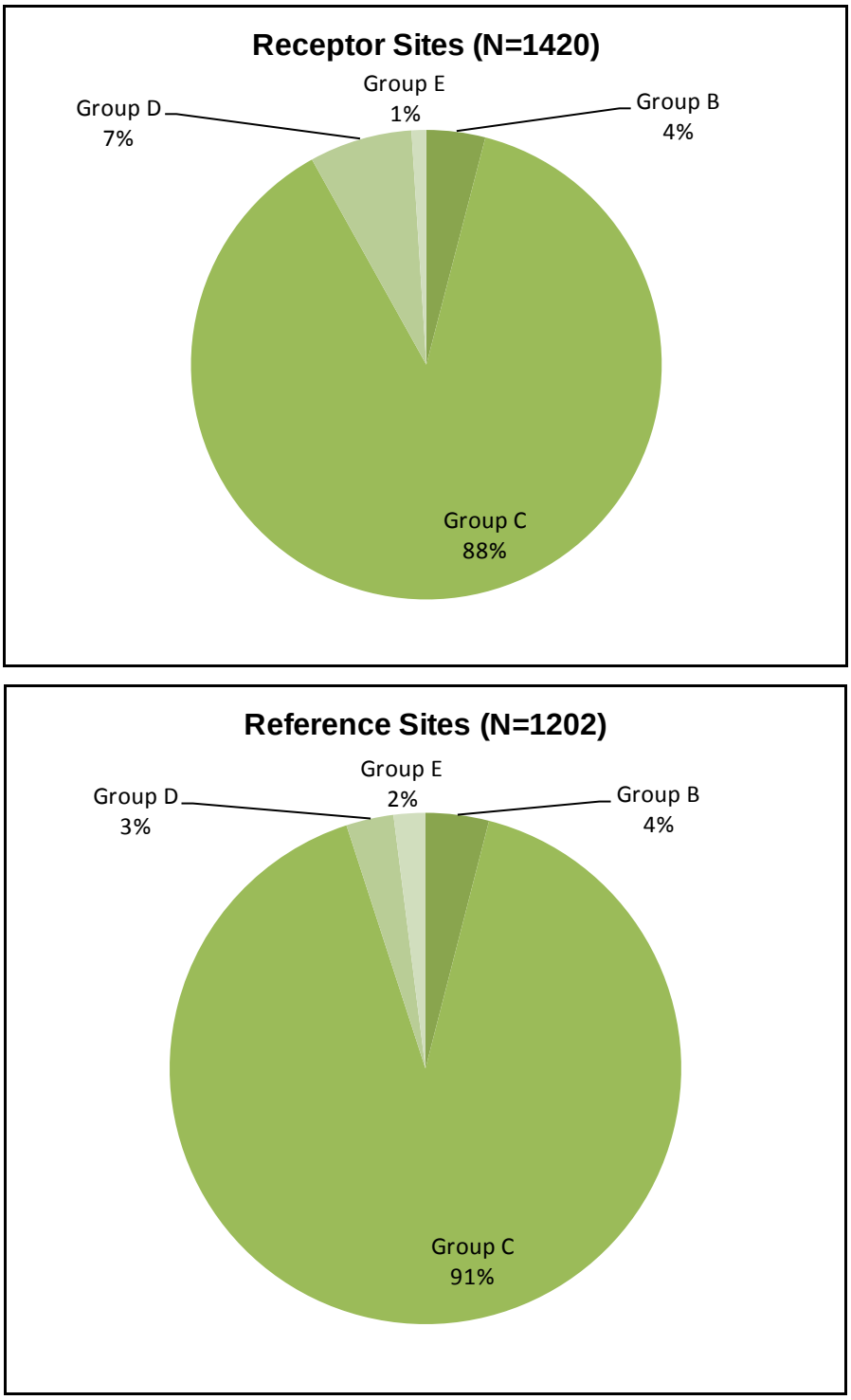


Figure 4 Overall classification of macroinvertebrate species present in terms of their pollution sensitivity (EPA methods). Based on numbers of groups present collectively at the reference and receptor sites.

The P/R ratio at all sites was considered very low as in previous surveys. This ratio, which is a measure of gross primary production to community respiration, is reduced by increasing numbers of shredders and collectors. The most common scraper recorded was River limpet *Ancylus fluviatilis*, the only other macroinvertebrate in this category being Microcaddislies (Hydroptilidae).

The P/R ratios at all sites are well below the threshold value of 0.75, above which an aquatic ecosystem is deemed autotrophic. The results of the current survey are indicative of a highly heterotrophic aquatic system (food supply originates from outside the aquatic system). The relative abundances of scrapers (which increase P/R ratio) was greatest at Sites N2 (P/R=0.165) and N3 (P/R=0.14). The P/R ratio at both all other sites was ≤0.01. The poor representation of scrapers throughout the surveyed stretch of river is consistent year after year. The changes in relative abundance of this FFG in successive surveys are slight and in the current situation, significant changes in P/R will not occur considering the scarcity of this FFG. The dominant FFG at all sites in 2015 was shredders and this continued in 2016, indicating that macroinvertebrates in the river within the study area are sustained largely by inputs to the river as opposed to using products of primary production. In the current survey, there was no significant difference between reference and receptor sites with regard to P/R ratios. This result does not indicate a change in primary production taking place within the River Nanny downstream of the Irish Cement discharge.

Table 11 presents a juvenile salmonid (salmon and trout) food index which assesses the likelihood of a predictable invertebrate food supply being available for juvenile salmonids. The results show that there was an unpredictable supply of food available at all sites with the exception of site N1. The 'predictable' result at N1 was brought about by the relatively high proportion of Simulidae and chironomidae. Overall, the poor supporting habitats, degraded water quality and limited food supply for salmonids along the study stretch of river are an indication of reduced salmonid potential for the River Nanny.

European Eel *Anguilla anguilla*, Brown Trout *Salmo trutta*, Nine-spined Stickleback *Pungitius pungitius* Minnow *Phoxinus phoxinus* and Three-spined Stickleback *Gasterosteus aculeatus* were recorded during the current field work both downstream and upstream of the discharge point. European Eel has been listed as ‘Critically endangered’ and is now ‘Red Listed’ according to ‘Red List No. 5: Amphibians, Reptiles & Freshwater Fish’ (King *et al*, 2011).

Table 9 Functional Group Analyses of macroinvertebrate species recorded at each site.

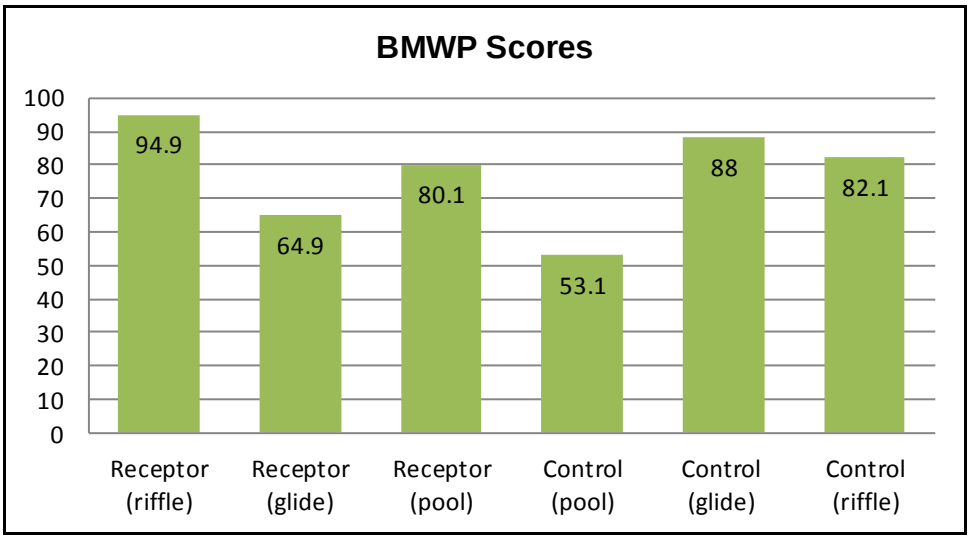
Site	Abundance	Functional Feeding Group					
		Filtering collector	Gathering collector	Predator	Scraper	Shredder	**Total**
1	Number	207	55	43	22	347	674
	% of total	31	8	6	3	51	100
2	Number	22	3	34	0	180	239
	% of total	9	1	14	0	75	100
3	Number	33	1	60	10	403	507
	% of total	7	0	12	2	79	100
4	Number	5	40	11	0	281	337
	% of total	1	12	3	0	83	100
5	Number	28	20	12	0	336	396
	% of total	7	5	3	0	85	100
6	Number	5	93	42	9	320	469
	% of total	1	20	9	2	68	100

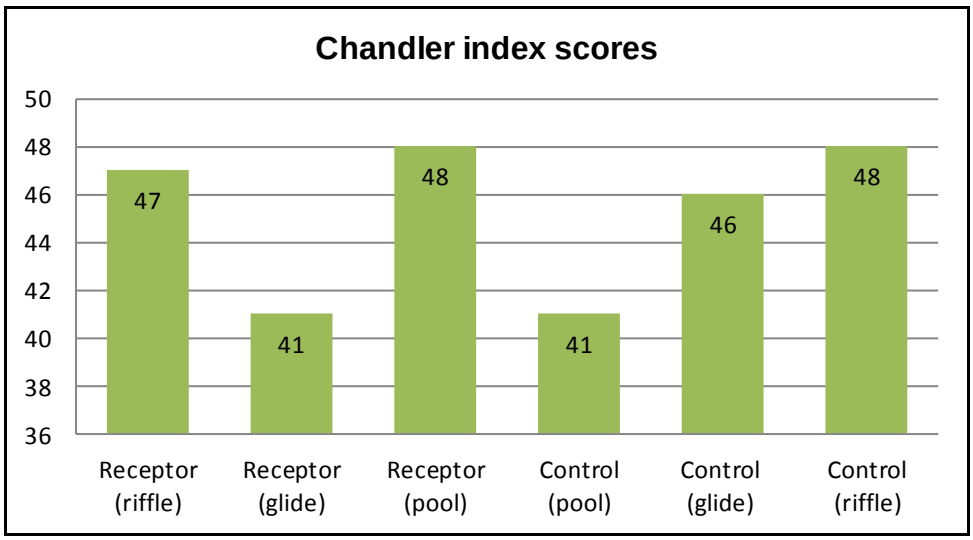
Table 10 Functional Group characteristics of the six survey sites. Dominant FFG (%) (Dominant group and its mean relative %); P/R (ratio of Grazers to total collectors + shredders, a surrogate for ratio of gross primary production to community respiration); Heterotrophy vs Autotrophy based on a P/R threshold of > 0.75 = autotrophic) (Rabenil *et al*, 2005).

Site	Type	Location	Dominant FFG (%)	P/R	Heterotrophy Vs Autotrophy
N1	Riffle	Receptor	Shredder (%) 51	0.07	Heterotrophic
N2	Glide	Receptor	Shredder (%) 75	0.165	Heterotrophic
N3	Pool	Receptor	Shredder (%) 79	0.14	Heterotrophic
N4	Pool	Reference	Shredder (%) 83	0.03	Heterotrophic
N5	Glide	Reference	Shredder (%) 85	0.03	Heterotrophic
N6	Riffle	Reference	Shredder (%) 68	0.10	Heterotrophic

Table 11 Juvenile salmonid food index. Predictable invertebrate supply is the ratio of behavioral drifters (filtering and gathering collectors) to accidental drifters (scrapers, shredders and predators). Based on a threshold of >0.50 for predictable supply (Rabenil *et al*, 2005).

Site	Type	Location	Behavioral drifters/accidental drifters	Predictable Vs Unpredictable
N1	Riffle	Receptor	0.64	Predictable
N2	Glide	Receptor	0.12	Unpredictable
N3	Pool	Receptor	0.07	Unpredictable
N4	Pool	Reference	0.15	Unpredictable
N5	Glide	Reference	0.14	Unpredictable
N6	Riffle	Reference	0.26	Unpredictable





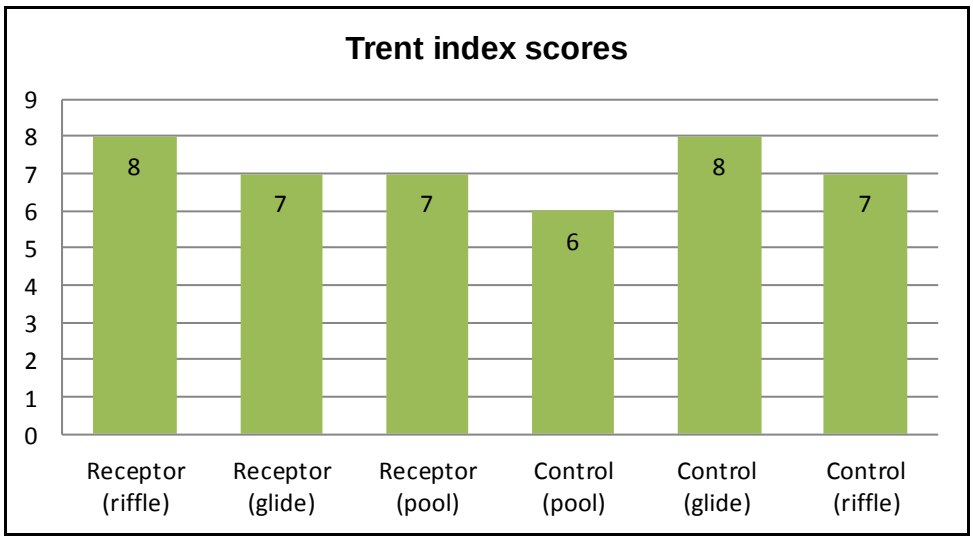


Figure 5 Variation of the BMWP Score, Trent Biotic Index and Chandler Biotic Index at the six survey sites.

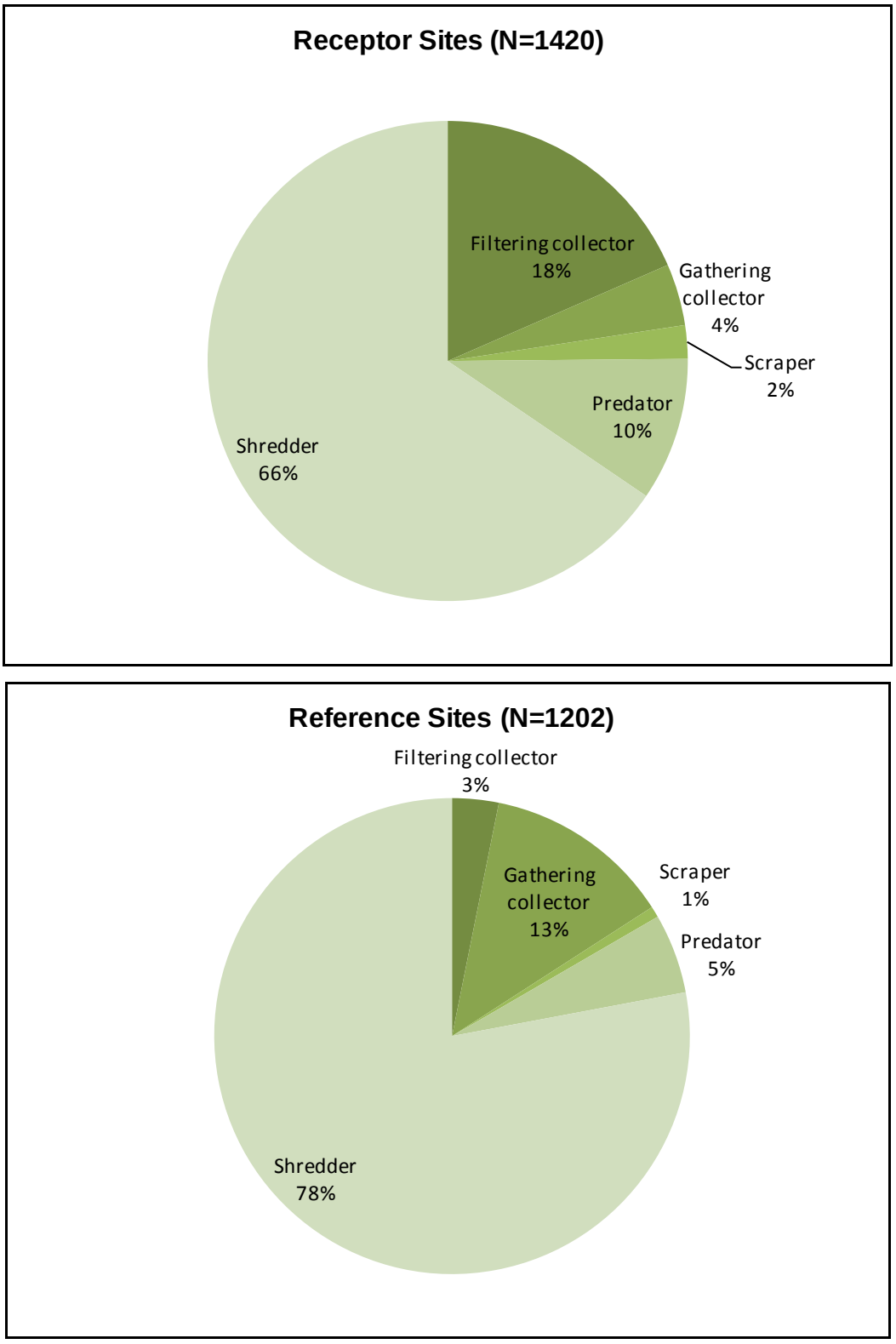


Figure 6 Overall Functional Group Analyses of macroinvertebrates collected from receptor and reference sites sampled on the River Nanny during June 2016.

3.7 Toxicology

The toxicity results indicate that the discharge from the Irish Cement Plant is non-toxic to two trophic levels. The results of the *Daphnia magna* bioassay and the Microtox system are outlined below.

3.7.1 Daphnia magna Bioassay

This test was deemed to be valid given that there was greater than 90% survival in the controls indicating that the animals and testing conditions were satisfactory (UK Environment Agency, 2007). Survival across the concentration series of effluent was 100% demonstrating that the effluent is non-toxic to D. magna. No LC50 value was generated for this bioassay due to the non-toxic nature of the effluent. Results of this bioassay are displayed in Figure 7. A concurrent reference toxicant bioassay using zinc sulphate was carried out alongside the effluent bioassay. This bioassay produced an EC50 of 3.7 mg/L of zinc sulphate, this EC50 value is in agreement with previously published data for D. magna (US EPA, 2007) and with ongoing toxicity testing at the ASU. This indicates that the animals were of suitable sensitivity to be used for toxicity testing. Water quality measurements in the test chambers remained within normal limits for the duration of the bioassay. These data are presented in Appendix 4.

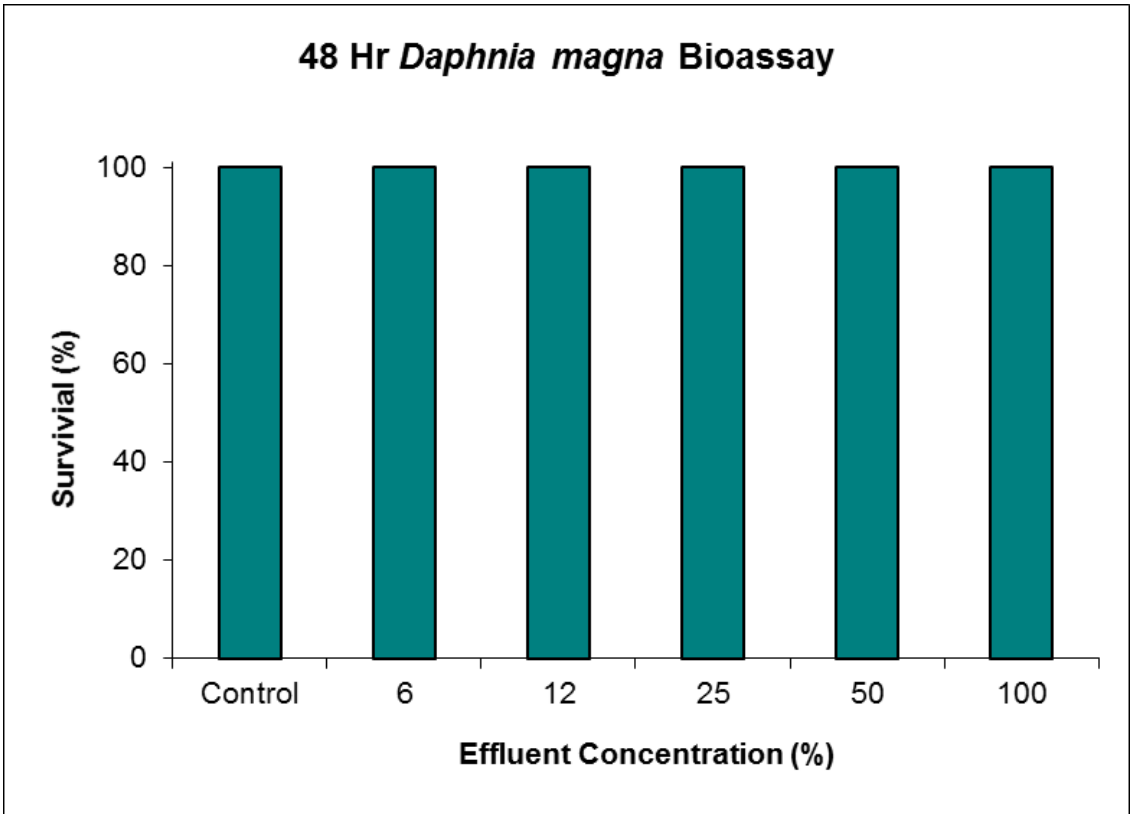


Figure 7 Average survival of *Daphnia magna* after 48 hours in a concentration series of the Irish Cement trade effluent.

3.7.2 Vibrio fischeri bacteria bioassay using Microtox system

The Microtox bioassay carried out was deemed to be valid. A reference toxicant test was carried out before actual testing of samples took place to ensure that the bacterium and reagents were suitable for

testing. The reference toxicant using the Zinc++ ion determined an EC50 of 1.19 mg Zn++/L after 15 minutes exposure. This is within the guideline range of 0.6-2.2 mg Zn++/L as specified by the Microtox manufacturer (Azur Environmental, 1995). These data are presented in Appendix 4.

No toxicity was observed between the controls and throughout the effluent concentration series. No significant decrease in light production was observed in any of the concentrations during the test. Some minor light stimulation was observed in all of the concentrations tested. Similar light stimulation has been shown to occur in other non-toxic samples and is an artefact of testing method. ASU have tested non-toxic blank samples (containing de-ionized water and osmotic adjusting solution) and recorded similar results. Based on the supporting data from the other bioassay it appears that this sample is also non-toxic using the Microtox system. The data for the effluent test are presented in Figure 8.

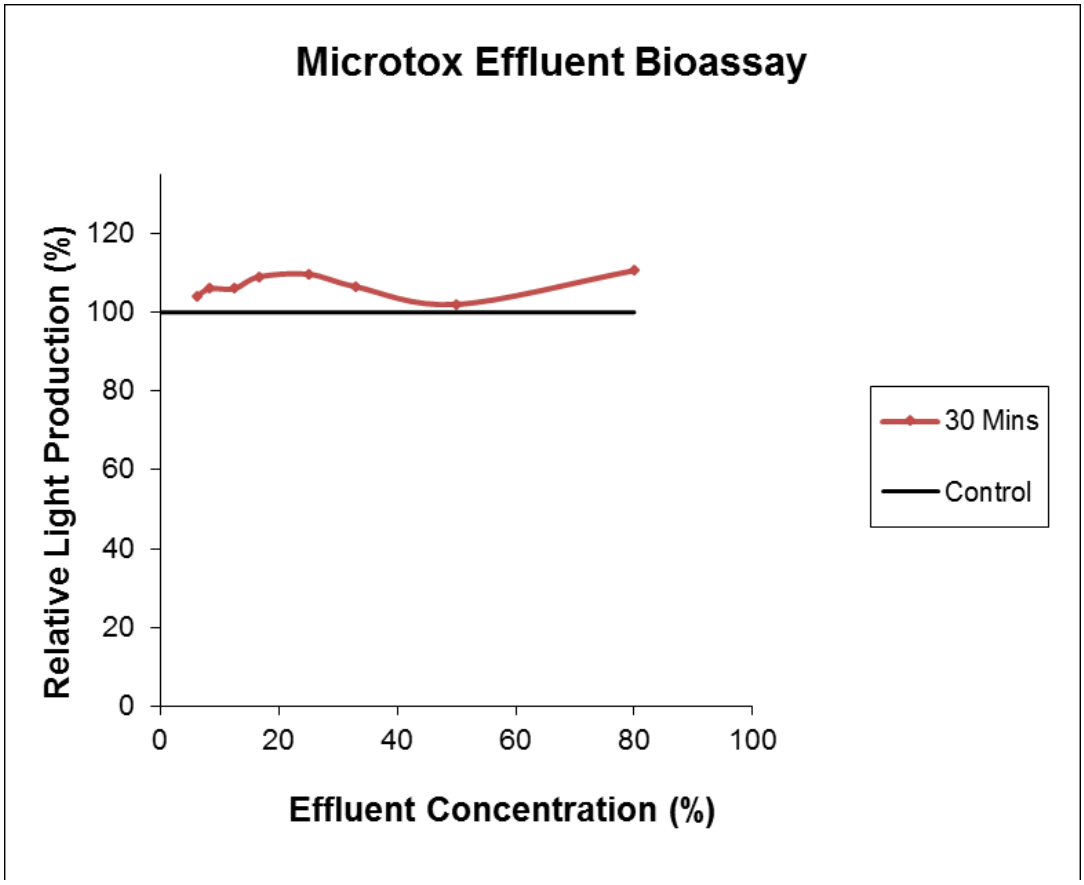


Figure 8 Plot of the Microtox results for Ecofact Nanny effluent sample on 07/07/16. Values represent light production relative to the controls. The highest concentration of effluent tested was 80%.

4. SUMMARY AND CONCLUSIONS

The macroinvertebrate community and sediments at six sites located within 500m upstream and downstream of the Irish Cement trade discharge outflow were investigated during June 2016. These sites selected were at the same locations as in previous surveys undertaken in between 2008 and 2015.

The entire River Nanny was in an unsatisfactory ecological condition when most recently monitored by the EPA in September 2014. The current river status of all watercourses in the Nanny catchment is either 'Poor' or 'Moderate'. The problems in the River Nanny are high nutrient concentration (Phosphorus, Ammonia, issues with level of oxygen in water) resulting in low ecological Rating. The cause of these pressures have been identified as agriculture, wastewater and industrial discharges, and septic tanks (ERDB, 2010).

Based on the current observations and during analysis of the data collected during 2016, there was no evidence to imply that the Irish Cement trade effluent was impacting on the substrate composition in the River Nanny, particular with reference to smaller sized materials. Substrates sampled at all sites were found to be dominated by sand of varying size. The primary concern with respect to the Irish Cement trade effluent is fine particles such as fine sands and silt/clay. There is no evidence that the proportion of these finer particles was elevated in the river Nanny downstream of the discharge point. The nearest sites to the discharge point are the pool sites N3 and N4. Any changes to the substrate composition owing to the discharge would be most obvious by comparison at these locations. In general, however, there was little disparity between the PSD at the pool sites upstream and downstream of the discharge, variation between sample sites N4 and N3 never being greater than 2% for particles less than 0.6mm. The most prominent difference between sites upstream and downstream was the greater fraction of finer particles at N5 when compared to its corresponding site N3 downstream. A considerable coat of silt was noted in the river both upstream and downstream of the discharge point. Such was the degree of siltation that a dense plume of sediment was released into the water column when kick sampling was performed at each site. Based on underwater observations of the river, there was no discernible difference in substrate siltation in the River Nanny upstream and downstream of the discharge point. The visual quality (clarity) of trade effluent from the Irish Cement was seen be much greater than the River Nanny when the river was visited during the current survey. However, overall it is concluded that the trade effluent from the Irish Cement Plant is not negatively impacting on the composition of the substrate in the river.

The diversity and abundance levels of macroinvertebrates recorded at all sites were considered to be typical of an organically polluted lowland Irish river. The macroinvertebrate fauna largely comprised pollution tolerant organisms such as freshwater shrimp *Gammarus duebeni,* mayfly larvae of *E. ignita,* Dipteran larvae of chironomids and the snail *Bithynia tentaculata.* There has been a slight decrease in the macroinvertebrate family richness of the surveyed stretch of the river since the previous surveys. Previously recorded pollution sensitive mayfly larvae of *Ecdyonurus* sp. were not found during the current assessment along with Group B cased caddisfly larvae of *Limnephilus lunatus, L. flavicornis,* or the pollution tolerant snail *Planorbis carinatus*. A changing macroinvertebrate composition as such indicates an aquatic environment in a state of instability and stress.

Water pollution in the River Nanny continues to be problem with algal growths and siltation obvious all along the surveyed stretch of the river. In previous assessments carried out in 2014 and 2015, the status of the river was also found to be moderate, corresponding with the most recent EPA biological water

quality monitoring results. Since 2014, there has been no change in the biological water quality, with the rating of all sites remaining unsatisfactory 'Moderately Polluted (Q3)', corresponding to WFD 'Poor status'.

Based on the current macroinvertebrate samples, BMWP scores at all sites were below 100. This is the first incidence of such a result since the BMWP biotic index was used to determine water quality in the study area. Using BMWP scores, there was no indication that the trade effluent discharge was impacting biological water quality, the average BMWP downstream of the discharge being 80. An average BWP of 74 was recorded for the three upstream reference sites. ASPT scores are considered more robust and unambiguous than BMWP scores. All of the sites surveyed recorded an ASPT score of 5.5 or below (scores equal to or above 5.5 are reflective of good water quality). Chandler biotic index values at all sites were well below the score of 80 (representative of unpolluted sites). The mean Chandler biotic index scores at receptor sites and reference sites was 45.3 and 45.0 respectively. Trent biotic index scores at all locations ranged from 6 to 8 and were collectively higher at the receptor sites by a negligible margin. Based on family diversity, BMWP, Trent and Chandler scores, there is no evidence to indicate that biological water quality is adversely affected downstream of the Irish Cement trade effluent discharge point.

Shredding macroinvertebrates were the most common functional feeding group at both the reference and receptor sites. Shredders specialise in the consumption of organic matter deriving from inputs such as leaves. Changes in functional groups reflect changes in food sources, nutrient processing and energy flow in the river system. The increase in the relative abundance of shredders and the low relative abundance of scrapers signify a shift away from primary instream production that would indicate a balanced and healthy aquatic ecosystem. The P/R ratio at all sites examined was very low as in previous surveys. This indicates that the River Nanny is highly heterotrophic. The scarcity of macroinvertebrate scrapers is a reflection of unsatisfactory water quality and supporting habitats at all of the sites investigated. In the current survey, there was insignificant difference between reference and receptor sites with regard to P/R ratios, especially considering the low P/R ratios (maximum of 0.165) and relatively high heterotrophic-autotrophic threshold of 0.75. The current results indicate that there is no discernible change in primary production taking place within the River Nanny downstream of the Irish Cement discharge.

The functional group analysis results suggest that there is an ‘Unpredictable’ juvenile salmonid food supply at all sites surveyed with the exception of Site N1. The generally 'Unpredictable' food supply result was brought about by the high proportion of shredders (mainly *Gammarus duebeni*). Other factors such as impaired water quality, including siltation does not suit salmonid production in the surveyed stretch of the river.

Toxicology testing was carried out on two different trophic levels using trade effluent from the Irish Cement plant. Toxicology test results showed that the effluent is non-toxic to the organisms tested. It is considered therefore that the discharge from the Irish Cement plant to the River Nanny does not adversely affect the ecology of River Nanny with respect to toxicity. In the way that lower trophic organisms are not affected by the discharge, it is considered also that the discharge does not adversely affect fauna higher in the food chain, such as macroinvertebrates recorded while biological sampling and fish supported by these. According to Chapman (1995), different views in the form of tools such as toxicity tests and field studies, together provide the best overall perspective. With regard to this approach, it is also deduced from the macroinvertebrate field sampling that the discharge is Non-Toxic. In

combination with the results of the macroinvertebrate assemblages and functional group analyses, it is considered that the discharge is not adversely impacting aquatic ecology within the River Nanny.

The River Nanny is in the Eastern River Basin District. In the Programme of Measures for the River Nanny Water Management Unit (WMU), the main pressure preventing achievement of Good Status is diffuse agricultural and septic tank pollution (ERBD, 2009). In this water management unit, naturally high levels of nutrients in the ground may also be an issue. The target date for achievement of 'Good status' in the River Nanny catchment has been set back to 2027. Based on the monitoring carried out between 2008 and 2016 for the Irish Cement trade effluent discharge, there appears to be no catchment wide changes bringing about improvements in the River Nanny as of yet.

The macroinvertebrate community and structure along the surveyed stretch of river changes from year to year with only pollution tolerant indicators continuing to exist in successive surveys. This changing state of the river is indicative of background pressures on aquatic ecology, and not related to the Irish Cement discharge.

The trade effluent from the Irish Cement plant does not appear to be adversely affecting BOD, hardness, Dissolved Oxygen (D.O.) in the River Nanny, as indicated by water quality results from samples taken upstream and downstream of the discharge. In fact, Dissolved Oxygen (D.O.) in the discharge was very close to 100%, the ideal saturation concentration. Organic compounds and Heavy Metals were not present in the sample of the discharge at a level considered harmful to the aquatic environment.

The results confirm that macroinvertebrate communities, biological water quality and sediment levels in the River Nanny are not significantly different upstream and downstream of the trade effluent from the Irish Cement plant. The discharge is considered to be having a neutral impact on the aquatic ecology of local areas of the River Nanny.

5 RECOMMENDATIONS

Biological monitoring of the River Nanny upstream and downstream of the discharge should be maintained in order to monitor the impact of the discharge on aquatic ecology. Similarly, the composition of substrates in the river should be monitored and Irish Cement Ltd. should continue monitoring chemical water quality upstream and downstream of trade effluent discharge on the River Nanny.

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PLATES

Plate 1 Site N1: receptor riffle site downstream of the weir (NOS grid ref O07976 69254). Water sampling was undertaken at N1 and N6.

Plate 2 Site N2: receptor pool site downstream of the outfall (NOS grid ref O07865 69186).

Plate 3 Site N3: receptor glide site (NOS grid ref O07783 69171).

Plate 4 Site N4: reference pool site (NOS grid ref O07589 69186).

Plate 5 Site N5: reference glide site (NOS grid ref O07537 69165).

Plate 6 Site N6 was located immediately downstream of the minor road bridge to Bellewstown (NOS grid ref O07349 69166).

Plate 7 Irish Cement plant at Platin, Duleek, Co. Meath.

Plate 8 Irish Cement trade effluent outfall to the River Nanny. Sampling of the effluent was undertaken at this location adjacent to the River Nanny (ca. 100 south of the R150).

Plate 9 Biological sampling at Site N61 in the River Nanny.

Plate 10 Biological sampling at each site included sweep netting through submerged aquatic vegetation. Seen above is Site N2.

Plate 11 Particle size distribution sample from Site N1 showing the trowel used to obtain the substrate samples.

Plate 12 Reading Conductivity of the discharge to the River Nanny.

Plate 13 Pollution tolerant freshwater shrimp *Gammarus duebeni* occurs in the subject stretch of the River Nanny at levels indicative of a stressed aquatic ecosystem.

Plate 14 Larvae of *Sericostoma personatum* from the macroinvertebrate sample taken at Site N3.

Plate 15 Larvae of the less sensitive Banded jewelwing *Agrion splendens* recorded at N3.

Plate 16 Larvae of the very pollution tolerant bloodworm *Chironomous* sp. and tolerant green chironomid recorded at Site N2.

Plate 17 Juvenile Eel *Anguilla anguilla* and Three-spined Stickleback *Gasterosteus aculeatus* recorded in the River Nanny at Site 1 during the June 2015 biological sampling.

Plate 18 Juvenile Brown Trout recorded during biological sampling at Site 1.

Plate 19 Nine-spined Stickleback *Pungitius pungitius* was among the fish species recorded during the current sampling.

Plate 20 Minnow *Phoxinus phoxinus* recorded at Site 6.

Plate 21 Filamentous algae *Cladophora sp.* growing in the River Nanny at Site N2.

Plate 18 Temperature controlled photometer apparatus used to test for bioluminescence of *Vibrio fischeri* in the 30 min EC_{50} test.

Appendix 1 Biotic Indices.

Table A1.1 Biological River Quality Classification (Q-Values).

'Q' value	Community Diversity	Water Quality	Condition*	Status	Quality
Q5	High	Good	Satisfactory	Unpolluted	Class A
Q4	Reduced	Fair	Satisfactory	Unpolluted	Class A
Q3	Much Reduced	Doubtful	Unsatisfactory	Slightly Polluted	Class B
Q2	Low	Poor	Unsatisfactory	Moderately Polluted	Class C
Q1	Very Low	Bad	Unsatisfactory	Seriously Polluted	Class D

* *'Condition' refers to the likelihood of interference with beneficial or potential beneficial use.*

The connection between the Q-rating system and the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) is given in Table A1.2 below.

Table A1.2 Water Framework Directive (WFD) ecological status classification and corresponding Q-rating.

Ecological status classification	Corresponding Q-rating
High	Q5, Q4-5
Good	Q4
Moderate	Q3-4
Poor	Q3, Q2-3
Bad	Q2, Q1

Table A1.3 BMWP Scoring System.

BMWP score	Category	Interpretation
0-10	Very poor	Heavily polluted
11-40	Poor	Polluted or impacted
41-70	Moderate	Moderately impacted
71-100	Good	Clean but slightly impacted
>100	Very good	Unpolluted, unimpacted

Table A1.4 Trent Biotic Index.

Trent Index	BOD (mg/l)	Status
9-10	2	Very Clean
7-10	2-3	Clean
6-8	2-3	Clean
5-6	3-5	Fairly Clean
3-5	5-10	Doubtful
2-4	5-10	Doubtful
1-3	10+	Bad
0-1	10+	Bad

Appendix 2 EPA Water Quality Data for the River Nanny

Table A2.1 Water quality in the River Nanny along with overall water quality in hydrometric area 8 (adapted from Clabby *et al.* 2008).

Catchment	Class A	Class B	Class C	Class D	Total (km)
Hydrometric Area 8 (km)	22.5	23	70	6.5	122
Hydrometric Area 8 (%)	18.4	18.9	57.4	5.3	100
Nanny (km)	6.5	12	9.5	-	28
Nanny (%)	23.2	42.9	33.9	-	100

Table A2.2 Biological Water Quality in the River Nanny (EPA Code 08N01). Data taken from the EPA website.

Station No.	Station location	Biological water quality ratings (Q-value)											
		1980	1982	1986	1988	1991	1996	1998	2001	2005	2008	2010	2014
0040	Folistown Br	-	-	-	-	-	2-3	2-3	2	2-3	3	3	3
0090	East Bridge, S. of Brownstown	-	-	-	2-3	2-3	-	-	-	-	-	-	-
0100	West Br Kentstown	-	-	-	-	-	-	-	-	-	-	-	-
0110	East Bridge, Kentstown	-	-	-	3	3	3	2-3	2-3	2-3	2-3	3	3
0200	Br just S. of Balrath X-Roads	3-4	2-3	3	3-4	3-4	-	-	-	-	-	-	-
0280	Bridge d/s Nanny Bridge	-	-	-	3	3	3	3-4	3-4	4	4	3-4	3
0300	Bridge near Deenes	3	1-2	2	-	3	-	-	-	-	-	-	-
0400	Upstream Bridge, Duleek	3-4	4	3-4	2-3	3	-	-	-	-	-	-	-
0500	Bridge N.E. of Bellewstown Ho	3	3-4	3-4	3	3-4	3	3-4	3-4	3-4	3	3-4	3-4
0600	Beaumont Bridge	3-4	3	3-4	3	-	-	-	-	-	-	-	-
0650	Dardistown Bridge	-	-	3-4	3-4	3-4	4	4	3	-	-	-	-
0700	Bridge at Julianstown	3	3-4	3-4	3-4	3	3-4	3-4	3	3-4	3-4	3	3-4

2014 EPA Assessment of the River Nanny: The Nanny River is unsatisfactory along the entire length surveyed. Since the 2010 survey, there has been a slight improvement at Station 0700, but a slight decline in quality at Station 0280.

Appendix 3 Test Reports for the discharge

Table A3.1 Hydrocarbon results from the sample taken of the Irish Cement discharge on 24th June 2016. (ISO17025 Accredited).

Hydrocarbon	LOD/Units	Results	Method
TPH / Oil and Greases	<1 mg/l	<1	TM235
Mineral Oil	<1 mg/l	<1	TM235

Table A3.2 Heavy Metal results from the sample taken of the Irish Cement discharge on 24th June 2016. (ISO17025 Accredited).

Heavy Metal	Units	Results	E.Q.S S.I. No.272 of 2009	Method
Arsenic	0.12µg/l	0.814µg/l	<25µg/l	TM152
Cadmium	0.1µg/l	<0.1µg/l		TM152
Chromium	0.22µg/l	4.02µg/l		TM152
Copper	0.85µg/l	<0.919µg/l	5µg/l	TM152
Lead	0.02µg/l	0.05µg/l	7.2µg/l	TM152
Nickel	0.15µg/l	1.33µg/l	20µg/l	TM152
Selenium	0.39µg/l	3.57µg/l		TM152
Zinc	0.41µg/l	0.41µg/l		TM152

Table A3.3 BOD (Biochemical Oxygen Demand) and Total Hardness results from Sites N1 and N6 on the River Nanny, sample taken on 24th June 2016. (ISO17025 Accredited = #).

	N1	N6	Method
BOD (mg/l) #	<1	<1	TM045
Total hardness (mg/l) #	282	302	TM228
Conductivity (µS/cm)	356	403	

Table A3.4 On - site chemical results from the sample of the discharge taken on 24th June 2016.

Parameter and units	Results
Dissolved Oxygen (%)	99.2
Dissolved Oxygen (mg/l)	10.01
Conductivity (µS/cm)	560
Temperature (°C)	14.8

Appendix 4 Sediment PSD results

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Ecofact Environmental Consultants Ltd
Tait Business Centre
Limerick

Attention: William O'Connor

CERTIFICATE OF ANALYSIS

Date:	12 July 2016
Customer:	D_ECOFACT_LIM
Sample Delivery Group (SDG):	160625-30
Your Reference:	
Location:	River Nanny
Report No:	368682

This report has been revised and directly supersedes 368675 in its entirety.

We received 9 samples on Saturday June 25, 2016 and 9 of these samples were scheduled for analysis which was completed on Tuesday July 12, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

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

Approved By:

Sonia McWhan
Operations Manager

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13657456	DISCHARGE			24/06/2016
13657454	N1			24/06/2016
13657455	N6			24/06/2016
13657446	NANNY N1			24/06/2016
13657447	NANNY N2			24/06/2016
13657449	NANNY N3			24/06/2016
13657450	NANNY N4			24/06/2016
13657451	NANNY N5			24/06/2016
13657453	NANNY N6			24/06/2016

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

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ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

LIQUID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			13657456	DISCHARGE			0.5l glass bottle
			13657454	N1			Dissolved Metals HNO3 Filtered 1lplastic (ALE221)
			13657455	N6			250ml BOD (ALE212) 1lplastic (ALE221)
BOD True Total	All	NDPs: 0 Tests: 2			X		X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1		X			
Mercury Dissolved	All	NDPs: 0 Tests: 1	X				
Metals by iCap-OES Unfiltered (W)	All	NDPs: 0 Tests: 2		X		X	
TPH by IR Oils and Greases	All	NDPs: 0 Tests: 1	X				

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ALcontrol Laboratories

CERTIFICATE OF ANALYSIS

Validated

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

SOLID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			13657446	NANNY N1			1kg TUB
			13657447	NANNY N2			1kg TUB
			13657449	NANNY N3			1kg TUB
			13657450	NANNY N4			1kg TUB
			13657451	NANNY N5			1kg TUB
			13657453	NANNY N6			1kg TUB
Passing Through >63µm sieve	All	NDPs: 0 Tests: 6	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 6	X	X	X	X	X	X

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ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG: 160625-30
Job: D_ECOFACT_LIM-1
Client Reference:

Location: River Nanny
Customer: Ecofact Environmental Consultants Ltd
Attention: William O'Connor

Order Number:
Report Number: 368682
Superseded Report: 368675

Results Legend
- # ISO17025 accredited.
- M mCERTS accredited.
- aq Aqueous / settled sample.
- diss.filt Dissolved / filtered sample.
- tot.unfilt Total / unfiltered sample.
- * Subcontracted test.
- ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
- (F) Trigger breach confirmed
- 1-5&+§@ Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	DISCHARGE	N1	N6	NANNY N1	NANNY N2	NANNY N3
			Depth (m)	-	-	-	-	-	-
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	24/06/2016	24/06/2016	24/06/2016	24/06/2016	24/06/2016	24/06/2016
			Sample Time	-	-	-	-	-	-
			Date Received	25/06/2016	25/06/2016	25/06/2016	25/06/2016	25/06/2016	25/06/2016
			SDG Ref	160625-30	160625-30	160625-30	160625-30	160625-30	160625-30
			Lab Sample No.(s)	13657456	13657454	13657455	13657446	13657447	13657449
			AGS Reference						
BOD, unfiltered	<1 mg/l	TM045			<1 #	<1 #			
Arsenic (diss.filt)	<0.12 µg/l	TM152		0.814 #					
Cadmium (diss.filt)	<0.1 µg/l	TM152		<0.1 #					
Chromium (diss.filt)	<0.22 µg/l	TM152		4.02 #					
Copper (diss.filt)	<0.85 µg/l	TM152		0.919 #					
Lead (diss.filt)	<0.02 µg/l	TM152		0.05 #					
Nickel (diss.filt)	<0.15 µg/l	TM152		1.33 #					
Selenium (diss.filt)	<0.39 µg/l	TM152		3.57 #					
Zinc (diss.filt)	<0.41 µg/l	TM152		<0.41 #					
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #					
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM228			282	302			
TPH / Oil & Greases	<1 mg/l	TM235		<1 #					
Mineral Oil	<1 mg/l	TM235		<1					
Moisture Content Ratio (% of as received sample)	%	PM024					24	28	23

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Validated

CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Results Legend		Customer Sample Ref.	NANNY N4	NANNY N5	NANNY N6			
#	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.	Depth (m)	-	-	-			
diss.filt	Dissolved / filtered sample.	Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
tot.unfilt	Total / unfiltered sample.	Date Sampled	24/06/2016	24/06/2016	24/06/2016			
*	Subcontracted test.	Sample Time	-	-	-			
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery	Date Received	25/06/2016	25/06/2016	25/06/2016			
		SDG Ref	160625-30	160625-30	160625-30			
(F)	Trigger breach confirmed	Lab Sample No.(s)	13657450	13657451	13657453			
1-5&+§@	Sample deviation (see appendix)	AGS Reference						
Component		**LOD/Units**	**Method**					
Moisture Content Ratio (% of as received sample)		%	PM024	22	38	22		

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Validated

CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM008	BS 1377:Part 1977	Particle size distribution of solid samples		
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM235	The Determination of Hydrocarbon Oils in Waters by Solvent Extraction, Infra red Absorption and Gravimetry 1983, HMSO, London	Determination of Total Petroleum Hydrocarbons (TPH) in Waters By Infra-Red Spectroscopy		

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

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Validated

CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Test Completion Dates

Lab Sample No(s)	13657456	13657454	13657455	13657446	13657447	13657449	13657450	13657451	13657453
Customer Sample Ref.	DISCHARGE	N1	N6	NANNY N1	NANNY N2	NANNY N3	NANNY N4	NANNY N5	NANNY N6
AGS Ref.									
Depth									
Type	LIQUID	LIQUID	LIQUID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
BOD True Total		30-Jun-2016	30-Jun-2016						
Dissolved Metals by ICP-MS	05-Jul-2016								
Mercury Dissolved	04-Jul-2016								
Metals by iCap-OES Unfiltered (W)		29-Jun-2016	29-Jun-2016						
Passing Through >63µm sieve				12-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016	05-Jul-2016
Sample description				01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016	01-Jul-2016
TPH by IR Oils and Greases	05-Jul-2016								

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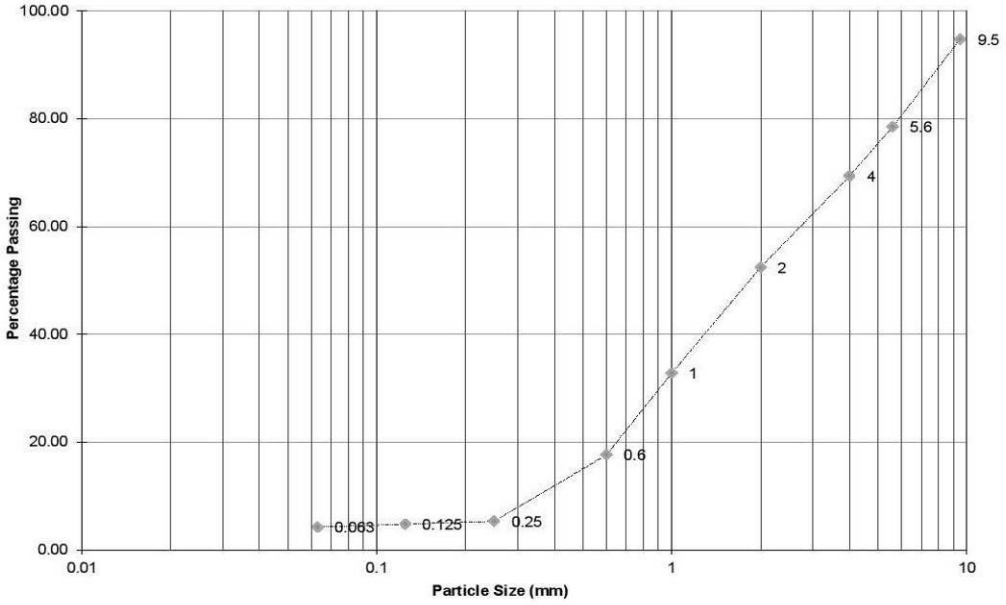
Particle Size Distribution

Particle Size (mm)	% Passing
9.5	94.73
5.6	78.46
4	69.36
2	52.42
1	32.78
600um	17.62
250um	5.31
125um	4.76
63um	4.18

Sample Number 13687973
Client D_ECOFACT_LIM
Sample ID NANNY N3
depth 0.00



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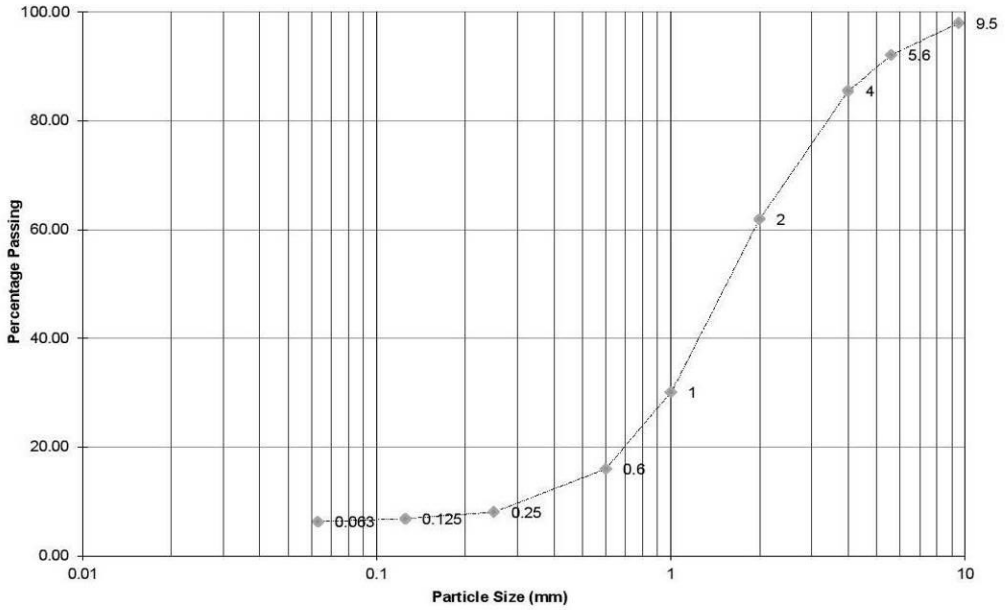
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	97.95
5.6	92.04
4	85.45
2	61.86
1	30.06
600um	15.96
250um	8.01
125um	6.78
63um	6.23

Sample Number 13688006
Client D_ECOFACT_LIM
Sample ID NANNY N2
depth 0.00



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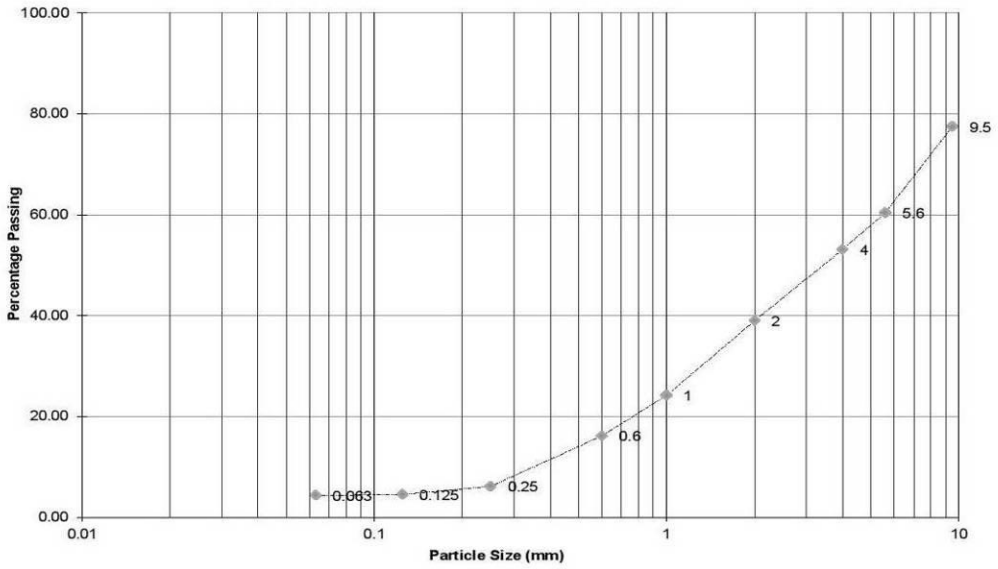
WS-701_1 ISSUED 30/05/2014

Particle Size Distribution

Particle Size (mm)	% Passing
9.5	77.42
5.6	60.36
4	53.07
2	38.94
1	24.18
600um	16.08
250um	6.09
125um	4.49
63um	4.34

Sample Number 13691980
Client D_ECOFACT_LIM
Sample ID NANNY N4
depth 0.00



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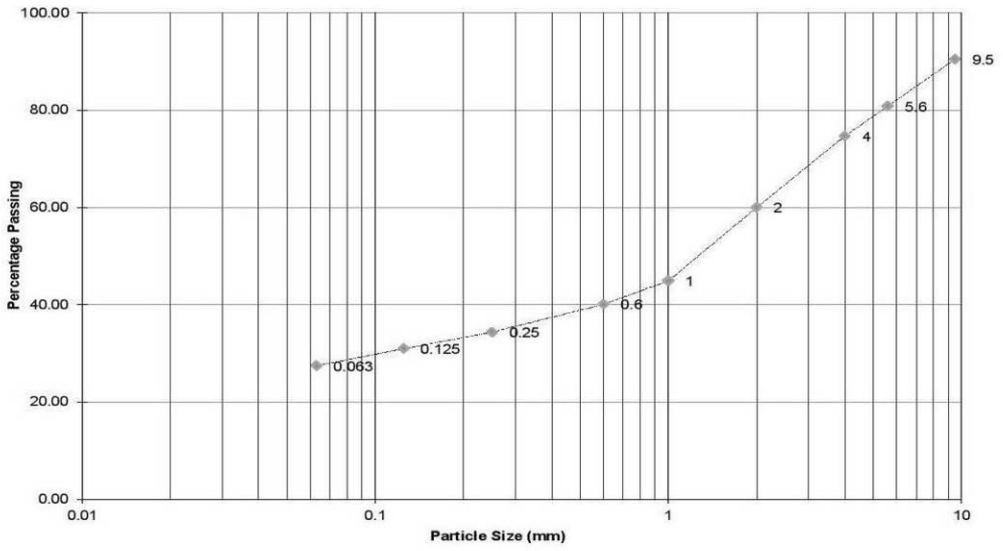
Particle Size Distribution

Particle Size (mm)	% Passing
9.5	90.46
5.6	80.80
4	74.69
2	59.97
1	44.91
600um	40.06
250um	34.32
125um	30.94
63um	27.43

Sample Number 13692150
Client D_ECOFACT_LIM
Sample ID NANNY N5
depth 0.00



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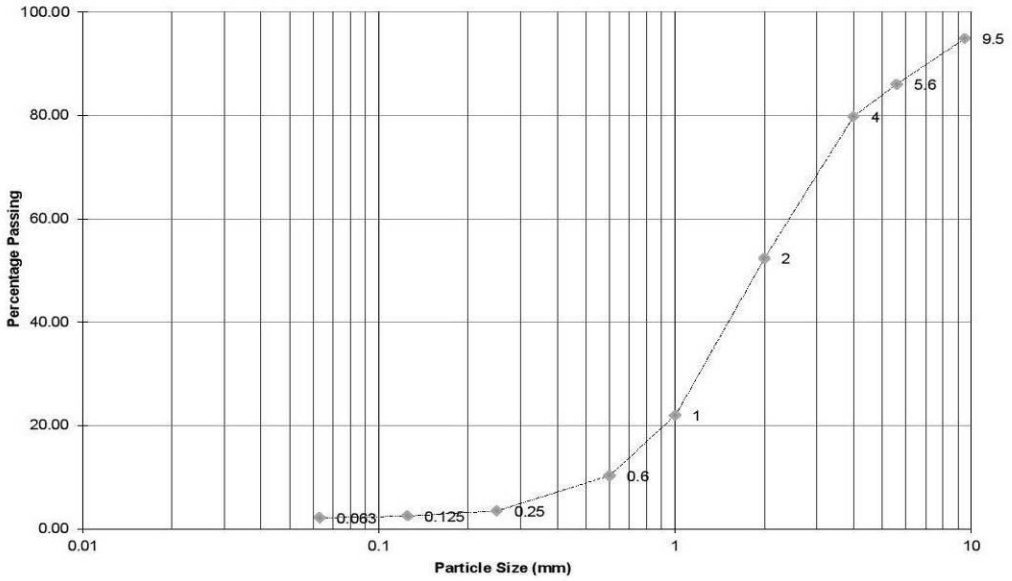
Particle Size Distribution

Particle Size (mm)	% Passing
9.5	94.83
5.6	86.02
4	79.78
2	52.32
1	21.91
600um	10.27
250um	3.42
125um	2.46
63um	2.11

Sample Number 13692222
Client D_ECOFACT_LIM
Sample ID NANNY N6
depth 0.00



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CERTIFICATE OF ANALYSIS

SDG:	160625-30	**Location:**	River Nanny	**Order Number:**	
Job:	D_ECOFACT_LIM-1	**Customer:**	Ecofact Environmental Consultants Ltd	**Report Number:**	368682
Client Reference:		**Attention:**	William O'Connor	**Superseded Report:**	368675

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

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

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

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

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

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

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

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

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

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

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

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

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

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

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

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

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

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

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Appendix 5 Toxicology results

Table A5.1 Water Quality Measurements for 48 Hour *Daphnia magna* Bioassay.

48 Hour Daphnia Bioassay

Ecofact Nanny Eff 05/07/16

Concentration (%)	Survival			D.O (mg/L)			pH			Conductivity(µS/cm)			Temp (ºC)		
	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs	0hrs	24hrs	48hrs
Control A	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control B	5	5	5	116.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control C	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
Control D	5	5	5	11.6		10.3	8.39		8.13	341		347	19.0	20.1	20.5
6.25A	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25B	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25C	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
6.25D	5	5	5	11.4		10.3	8.43		8.27	366		370	19.0	20.1	20.5
12.5A	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5B	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5C	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
12.5D	5	5	5	11.6		10.2	8.35		8.29	387		375	19.0	20.1	20.5
25A	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25B	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25C	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
25D	5	5	5	12.3		10.2	8.19		8.36	429		428	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50A	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
50B	5	5	5	12.4		10.2	7.99		8.45	510		507	19.0	20.1	20.5
100A	5	5	5	11.8		9.3	7.80		8.22	673		603	19.4	20.1	20.5
100B	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5
100C	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5
100D	5	5	5	11.8		9.3	7.8		8.22	673		603	19.4	20.1	20.5

Notes

Day 0 Initiated at 14.00 , animals less than 24hrs old in initiation

24hrs 9.40

48hrs Terminated test at 12.00

Testing performed by Aquatic Services Unit, ERI Building, Lee Rd., Cork

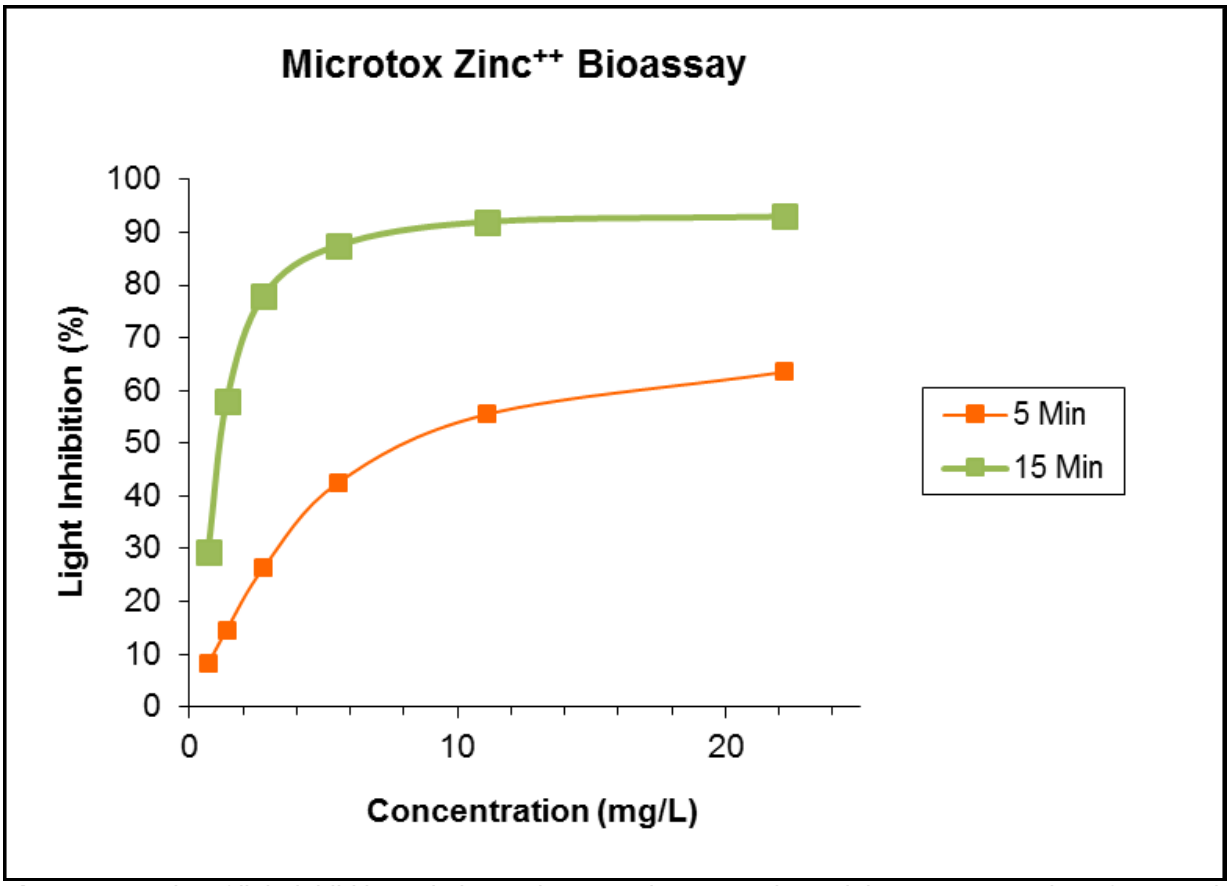

Figure A5.1 Plot of light inhibition relative to the controls versus zinc sulphate concentration after 5 and 15 minutes exposure.

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