6.0 WATER AND HYDROLOGY

6.1 INTRODUCTION

This chapter of the Environmental Impact Statement (EIS) was undertaken by AWN Consulting Ltd (AWN) on behalf of NCCCL to assess the impact of the existing facility at Kanturk, Co. Cork on the water and hydrology environment.

The potential impacts and mitigation measures for water and hydrology for the existing facility are set out in the following sections.

The site is the existing NCCCL facility at Bluepool Lower, Kanturk (Figure 6.1). It is located at the southern edge of Kanturk town, and is situated on the right (western) bank of the River Allow. The site is bounded to the north by existing residential and commercial development, to the east by the River Allow, to the south by open space, and to the west by existing residential/commercial development and Bluepool Lower road. Existing ground levels at the site range from approximately 80.7 mOD Malin to 81.7 mOD Malin. The creamery site comprises an area of built structures at the northern end of the site and pasture land (greenfield) at the southern end. The site for which this EIS is being prepared is owned by NCCCL. A small area of the site is leased to another company called Bioatlantis. The main process being undertaken by Bioatlantis on the NCCCL site is described in Chapter 2 of this EIS. In summary the Bioatlantis activities which take place on site includes the receipt, washing, chopping and drying of seaweed, followed by the extraction of seaweed nutrients. The resulting material undergoes evaporation and spray drying.

6.2 ASSESSMENT METHODOLOGY

In addition to the EPA Guidelines and Advice Notes referred to in Chapter 1, consideration has also been given to the document entitled '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* by the National Roads Authority (NRA, 2009). These guidelines are referenced where the methodology for assessment of impact is appropriate (refer Appendix 6.1).

The rating of potential environmental impacts on the water/ hydrology environment is based on the matrix presented in Appendix 6.1, Table 1 – 'Glossary of Impacts following EPA Guidance Documents' which takes account of the quality, significance, duration and type of impact characteristic identified.

In the EIS assessment, consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that attribute. The impact ratings presented in Appendix 6.1 Table 3 are in accordance with impact assessment criteria provided in the EPA (2002) publication.

The following sources of information were consulted:

- Current EPA on-line database - Envision water quality monitoring data for watercourses in the area;
- South Western River Basin District (ERBD) Management Plan;
- The Planning System and Flood Risk Management, Guidelines for Planning

Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW));

- Office of Public Works (OPW) flood mapping data (www.floodmaps.ie);

The attributes (and impacts) to be assessed include *inter alia* the following:

- River and stream water quality in the vicinity of the site (where available);
- Surface watercourses near the site and potential impact on surface water quality arising from any discharge of surface water run-off;
- Localised flooding (potential increase or reduction) and floodplains including benefitting lands and drainage districts (if any); and
- Surface water features within the area of the site.

Site-specific data was derived from the following sources:

- Consultation with site engineers;

6.3 RECEIVING ENVIRONMENT

This section has been prepared to identify and assess the impact of the existing NCCCL facility on the surrounding surface water environment and introduce the relevant mitigation measures.

The site is located on the west bank of the River Allow. The River Allow is designated within the River Blackwater (Cork/Waterford SAC) as it supports populations of Annex II freshwater pearl mussels, Atlantic salmon and lamprey species, as well as the Annex I habitat 'floating river vegetation', listed on the EU Habitats Directive (1992). The NCCCL site is located on the bank of the River Allow and a portion of the site along the riparian corridor lies within the designated SAC boundary. It is considered that the Natura 2000 site boundary follows the historical 6 inch mapping field boundaries along the river corridor and therefore has not taken account of the presence of the NCCCL facility at this location. It is not expected that the creamery yard and portions of the processing plant should be included for designation within this SAC.

The existing facility and its processes does not entail any direct discharges to ground. Sludge waste from the onsite wastewater treatment plant is landspread over nine farms in Cork, Kerry and Limerick. This is discussed in more detail in Chapter 5. The focus of this assessment has therefore been on existing surface water environment and potential impacts on surface water.

6.3.1 Surface Water

The NCCCL site is located within the South Western River Basin District (SWRBD) in Hydrometric Area No. 18 of the Irish River Network. It is within the River Blackwater (Munster) Catchment which drains an area of approximately 3,295 km^2.

The existing facility is situated on the western bank of the River Allow (see Figure 6.1). The River Allow rises approximately 20km northwest of Kanturk, close to the border with County Limerick. A tributary of the River Allow, the River Dalua, flows into the River Allow in Kanturk town, a short distance (approximately 60m)

upstream of the site. The total catchment area of the River Allow upstream of the site is 264 km^2.

6.3.2 Water Quality

6.3.2.1 Water Quality Context

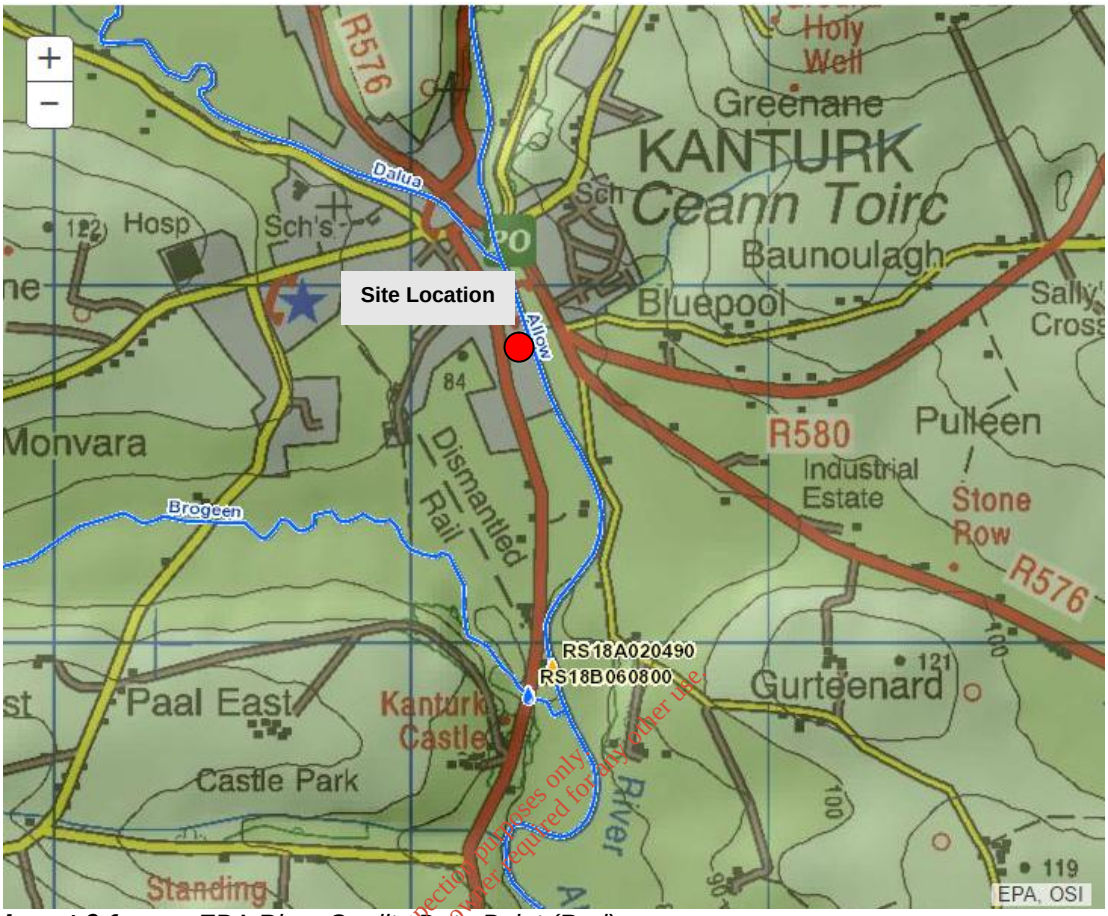
The existing development is located within the South Western River Basin District (SWRBD) as defined under the EU Water Framework Directive (2000/60EC) European Communities Directive 2000/60EC, establishing a framework for community action in the field of water policy, (commonly known as the Water Framework Directive [WFD]).

The WFD requires 'Good Water Status' for all European waters by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'good ecological status' and 'good chemical status'.

The status of the River Allow is classed as *'Poor'*, and is '*at risk of not achieving Good status'.* Full implementation of the WFD measures is expected to correct this, however it is estimated within the river basin management plan that the River Allow will not achieve *Good Status* until 2021.

6.3.2.2 Surface Water Quality Results

The EPA has been monitoring the water quality at two locations on the River Allow (see Insert 6.1), RS18A020490 (1.3km downstream Kanturk Bridge) and RS18B060800 (bridge upstream of Allow River confluence). Both locations are approximately 560m downstream of the existing facility. The most recent surface water monitoring result available is quarter 4 2015 and the water quality was reported as *Poor* (Q3) at the more relevant site RS18A020490 and *High* (Q4-5) at RS18B060800 located on a tributary.



Insert 6.1 *EPA River Quality Data Point (Red)*

6.3.3 On-Site Surface Water and Effluent Drainage

Stormwater/surface water arising on the site from yard areas, building roofs and hardstanding is discharged to the River Allow via five discharge points. Any areas where runoff may be impacted have been redirected to foul. There is currently very limited data on surface water quality. Grab samples were collected in November 2016 for three of the five samples and the results are presented below.

Sample ID	Stormwater Discharge Points			
	COD	**BOD**	**pH**	**TSS**
SW2	5	2	7.6	5
SW7	<10	5	5.8	<10
SW8	<10	<4	5.8	<10

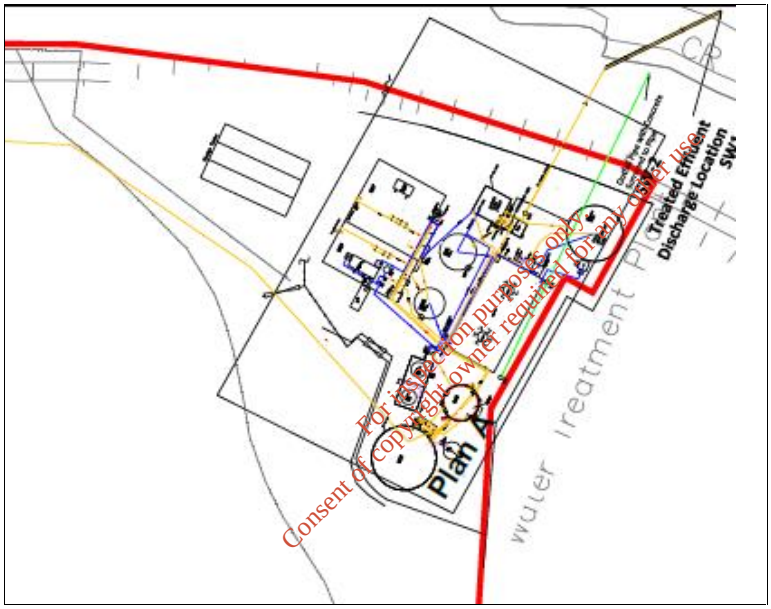
Effluent Water Discharge Results

All process wastewater generated and run-off from areas of potential contamination to stormwater is directed to the on-site wastewater treatment plant (WWTP) prior to discharging to the River Allow at emission point SW-1 as shown on Insert 6.2 below. This includes process, cooling and CIP wastewater which is delivered via underground pipe network directly to the WWTP. There are five sumps on site, all

of which discharge to the WWTP. The locations of the collection sumps are also shown in Drawing No. 7 of the IED application.

The discharge to River Allow from the WWTP is currently licensed by Cork County Council (WP(W)09/11). This licence permits the facility to discharge 650 m^3/day or 800m^3/day (the higher figure permitted during the months of May, June and July). The process wastewater drainage system for the site are included with the IED licence application.

Biochemical Oxygen Demand (BOD), nitrates and phosphates are parameters monitored under the current effluent discharge licence which are listed in the Schedule of EPA (Industrial Emissions) (Licensing) Regulations 2013 (S.I. 137 of 2013). Monitoring results for 2016 year to date for these parameters are presented in Table 6.1 below. All results are within guidance limits for discharges to water specified in the BAT guidance notes for the dairy processing industry.



Insert 6.2 *Location of Emission Point SW1*

	WWTP Discharge Data							
	BOD	COD	Total Nitrogen	Ortho-phosphate	Total Phosphorus	Total Suspended Solids	Ammonia	Fats, Oils, Grease
Licence Limits (mg/L)	**10 mg/L**	**125 mg/L**	**15 mg/L**	**1.4 mg/L**	**2 mg/L**	**20 mg/L**	**0.5 mg/L**	**5 mg/L**
02/02/2016	4	22	-	0.6	-	23	<0.5	-
05/02/2016	7	47	13.9	<0.1	0.9	<10	<0.5	<5
01/03/2016	**16**	72	14.1	1.3	1.1	20	<0.5	<5
22/04/2016	**19**	81	**17.9**	0.8	**2.1**	<10	<1.0	<5
27/05/2016	**11**	71	8.9	1.2	1.1	29	<0.5	-
10/06/2016	**16**	55	6.2	0.3	1.1	19	<0.5	<5
16/06/2016	**12**	52	1.9	**3.3**	-	25	<0.2	<5
07/07/2016	10	58	3.0	1.1	**4.0**	18	0.4	<5
25/08/2016	**15**	63	-	0.6	1.3	<10	0.2	<5
01.09.2016	4	28	3.4	1.2	1.2	<10	0.2	<5
06/10/2016	6	37	2.5	1.3	1.2	24	<0.2	<5
17/11/2016	<4	12	2.2	0.8	-	<10	<0.2	<5

Table 6.1 WWTP Discharge to River Allow: Monitoring Results - 2016

As there is no constant monitoring point upstream of the NCCCL site dedicated to monitoring specifically for NCCCL, there is no recent data available to characterise the river water quality immediately upstream. Consequently it is not possible to accurately calculate the available assimilative capacity of the river directly at the site discharge. However the NCCCL site is located a short distance upstream of the Kanturk municipal WWTP where the assimilative capacity has been assessed by monitoring. Irish Water have prepared Annual Environmental Reports which include upgradient and downgradient data for the Kanturk WWTP. The upgradient and downgradient monitoring locations are noted in Figure 6.3 below.

Insert 6.3 Monitoring points for Kanturk WWTP (green), Kanturk WWTP discharge point (blue) and NCCCL's discharge point (yellow). Source: Cork County Council.

The results for 2015 and 2016 are shown in Tables 6.2 and 6.3 of this document.

A short summary of the downgradient water quality data which confirms assimilative capacity based on achieving " Good" water quality in relation to the parameters measured is as follows:

BOD:
In 2015 the 95%ile EQS for BOD (≤2.6mg/L) was exceeded just once, in May (2.8mg/L).This exceedance resulted in the mean 95%ile EQS of 2.66mg/L slightly exceeding the 95%ile EQS.

In 2016 to date, the 95%ile BOD (2.175mg/L) did not exceed the 95%ile EQS (≤2.6mg/L).

Orthophosphate:
In 2015 and 2016 orthosphosphate did not exceed the 95%ile EQS of ≤0.075mg/L.

Ammonia:
In 2015 the 95%ile EQS for Ammonia (≤0.140mg/L) was exceeded just once, in July (0.165mg/L). This resulted in the mean 95%ile of 0.15mg/L exceeding the 95%ile EQS.

In 2016 to date, the 95%ile EQS for Ammonia (≤0.140mg/L) was exceeded in May (0.467mg/L). This resulted in the mean 95%ile of 0.305mg/L exceeding the 95%ile EQS. It is noted that the discharge from NCCCL is low in terms of ammonia concentration i.e. is not a significant contributor to the exceedances noted downgradient of the WWTP.

This data indicates the River Allow has the assimilative capacity to satisfactorily accept the orthophosphate and BOD loading from NCCCL's WWTP, the stormwater discharge from the five surfacewater discharge points on site, along with that of Kanturk's WWTP.

Kanturk D0203-01 Upstream Ambient Monitoring (2015)										
Sample Date	**11.02.2015**	**10.03.2015**	**09.04.2015**	**07.05.2015**	**03.06.2015**	**15.07.2015**	**12.08.2015**	**09.09.2015**	**07.10.2015**	**11.11.2015**
BOD mg/L	1.1	0.5	1.4	1.1	1.6	0.5	0.5	1.5	0.5	2
PO_4-P mg/L	0.018	0.0187	0.0234	0.0147	0.0153	0.0189	0.05	0.0873	0.021	0.038
Ammonia as N mg/L	0.13	0.00617	0.0172	0.0059	0.017	0.0219	0.04	0.135	0.021	0.038
pH	7.5	7.7	7.9	7.6	7.5	7.9	7.8	7.8	7.8	7.5

Kanturk D0203-01 Upstream Ambient Monitoring (2015)			EQS	
	Mean Value	**95% percentile**	**Mean**	**95%ile**
BOD	1.1	1.82	≤1.5	≤2.6
PO_4-P	0.0	0.070515	≤0.035	≤0.075
Ammonia as N	0.0	0.13275	≤0.065	≤0.140
pH	7.7	7.09	Bet 6 & 9	Bet 6 & 9

Kanturk D0203-01 Downstream Ambient Monitoring (2015)										
Sample Date	**11.02.2015**	**10.03.2015**	**09.04.2015**	**07.05.2015**	**03.06.2015**	**15.07.2015**	**12.08.2015**	**09.09.2015**	**07.10.2015**	**11.11.2015**
BOD mg/L	1.2	1.4	1.4	2.8	1.9	1.6	0.5	1.6	1.2	2.5
PO_4-P mg/L	0.024	0.0348	0.0216	0.0378	0.036	0.0612	0.04	0.0581	0.032	0.039
Ammonia as N mg/L	0.034	0.0201	0.0157	0.0074	0.046	0.165	0.02	0.135	0.116	0.012
pH	7.7	7.8	7.9	7.4	7.6	8.0	7.8	7.8	7.8	7.6

Kanturk D0203-01 Downstream Ambient Monitoring (2015)			EQS	
	Mean Value	**95% percentile**	**Mean**	**95%ile**
BOD	1.6	2.665	≤1.5	≤2.6
PO_4-P	0.0	0.059805	≤0.035	≤0.075
Ammonia as N	0.1	0.1515	≤0.065	≤0.140
pH	7.7	7.955	Bet 6 & 9	Bet 6 & 9

Table 6.2 Extracts from results of ambient monitoring upstream and downstream of Kanturk's municipal WWTP in 2015.
Source: Annual Environment Reports (2015) for D0203-01, Kanturk, in County Cork

Kanturk D0203-01 Upstream Ambient Monitoring (2016)										
Sample Date	**11.02.2016**	**15.03.2016**	**06.04.2016**	**18.05.2016**	**01.06.2016**	**13.07.2016**	**30.08.2016**	**14.09.2016**	**04.10.2016**	**03.11.2016**
BOD mg/L	2	0.5	1.1	1.9	0.5	1.7	1.2	1.5	1.1	0.5
PO_4-P mg/L	0.0311	0.016	0.015	0.00405	0.00538	0.0283	0.0316	0.052	0.034	0.013
Ammonia as N mg/L	0.135	0.021	0.02	0.00422	0.132	0.0408	0.0215	0.302	0.018	0.098
pH	7.5	7.8	7.8	8.4	7.9	7.9	7.8	7.5	7.7	8.1

Kanturk D0203-01 Upstream Ambient Monitoring (2016)			EQS	
	Mean Value	**95% percentile**	**Mean**	**95%ile**
BOD	1.2	1.955	≤1.5	≤2.6
PO_4-P	0.023	0.0439	≤0.035	≤0.075
Ammonia as N	0.079	0.22685	≤0.065	≤0.140
pH	7.7	8.265	Bet 6 & 9	Bet 6 & 9

Kanturk D0203-01 Downstream Ambient Monitoring (2016)										
Sample Date	**11.02.2016**	**15.03.2016**	**06.04.2016**	**18.05.2016**	**01.06.2016**	**13.07.2016**	**30.08.2016**	**14.09.2016**	**04.10.2016**	**03.11.2016**
BOD mg/L	1.9	1.9	1.1	1.7	0.5	2.4	0.5	1.3	1.2	1.2
PO_4-P mg/L	0.0311	0.022	0.02	0.0191	0.00562	0.0512	0.049	0.032	0.034	0.089
Ammonia as N mg/L	0.107	0.026	0.026	0.467	0.0288	0.0612	0.024	0.026	0.006	0.0103
pH	7.5	7.7	7.8	7.9	7.9	7.8	7.6	7.6	7.7	8.9

Kanturk D0203-01 Upstream Ambient Monitoring (2016)			EQS	
	Mean Value	**95% percentile**	**Mean**	**95%ile**
BOD	1.370	2.175	≤1.5	≤2.6
PO_4-P	0.027	0.05021	≤0.035	≤0.075
Ammonia as N	0.086	0.305	≤0.065	≤0.140
pH	7.760	8.01	Bet 6 & 9	Bet 6 & 9

Table 6.3 Results of ambient monitoring upstream and downstream of Kanturk's municipal WWTP for 2016 .
Source: Currently unpublished data, provided by Cork County Council.

In addition, monthly sampling of NCCCL's discharge from the WWTP showed that ammonia levels were <0.2mg/L in July 2015 (as they were for all months in 2015) and < 0.5mg/L in May 2016 (as they were for all months in 2016 except for April). The licence limit for ammonia in NCCCL's WWTP discharge to the River Allow is 0.5mg/L so it would appear that ammonia concentrations from NCCCL's site were not a contributing factor to the raised ammonia levels downstream of the Kanturk WWTP. The exceedance of the EQS for ammonia in the downstream monitoring of the Kanturk municipal WWTP is therefore likely to have been due to some contamination source unrelated to the NCCCL site.

6.3.4 Flooding

A Stage 1 Flood Risk Assessment was carried out by JBA Consulting in July 2011. The report is included as Appendix 6.2 of this chapter.

The identification of the flood risk to the site was obtained by following the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - The Planning System and Flood Risk Management Guidelines for Planning Authorities, November 2009, hereafter referred to as the FRM Guidelines. As per the FRM Guidelines a tiered approach has been taken. This usually begins with a Stage 1 Assessment which aims to quantify the risk posed to the development and to the surrounding environment by this development.

This Assessment follows the FRM Guidelines; the methodology involves researching the following data sources:

- Base maps – Ordnance Survey of Ireland;
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie Office of Public Works (OPW);
- CFRAM PFRA Maps, http://www.cfram.ie/pfra/, (OPW);
- Geological Survey of Ireland (GSI) maps on superficial deposits.

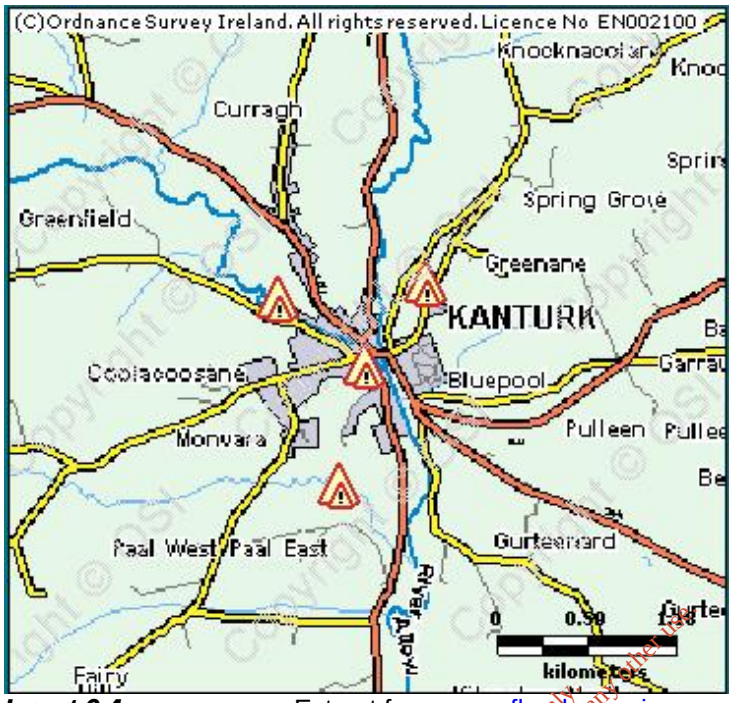
The NCCCL facility is situated on the western bank of the River Allow which rises approximately 20km northwest of Kanturk, close to the border of Co. Limerick. A tributary of the River Allow, the River Dalua, flows into the River Allow in Kanturk town approximately 60m upstream of the site. The OPW floodmaps were consulted which provides historical data on pluvial and fluvial flood events. The website has records of flooding in Kanturk as shown on Insert 6.4 and summarised in Table 6.4 below.

Date of Flooding	Details
October 2004	Brogeen River
August 1986	Rivers Dalua and Allow, Kanturk
June 1982	River Dalua, Kanturk Park
November 1980	River Dalua, Kanturk
Recurring	River Dalua at Kanturk Town Park
Recurring	River Allow R579 Strand Street Kanturk.
Recurring	Brogeen River
Recurring	Greenane, near Kanturk

Table 6.4 *Historic flood events recorded on floodmaps.ie*

The Catchment Flood Risk Assessment Management (CFRAM) Preliminary Flood Risk Assessment (PFRA) was consulted and identified the site as residing in Flood Zone B (between 1 in 100 and 1 in 1000 change of flooding per year). This concludes that there is a moderate probability of flooding to the site. It should be noted that no flood modelling was undertaken in the production of the PFRA maps

and were obtained through historic flood analysis and extensive consultation with local authorities.



Insert 6.4 Extract from www.floodmaps.ie

6.3.5 Water Supply

The NCCCL facility utilises 156,000m^3 of water per annum. Water is sourced primarily from two wells which are located on site.

The Bioatlantis operation used 13,506m^3 and 13,999m^3 of water in 2014 and 2015 respectively. This reflects an increase in water use of 3.7% in 2015. This water is sourced from the Kilrush mains supply

6.3.6 Rating Of Site Importance of the Hydrological Features

Based on the NRA methodology (See Appendix 6.1, Table 2) and the criteria for rating site importance of hydrological features, the importance of the hydrological features at this site is categorised as "Extremely High'' based on the proximity of the site to the Blackwater River SAC (Site Code 002170).

6.4 CHARACTERISTICS OF THE EXISTING DEVELOPMENT

The characteristics of the existing development which relate to Water and Hydrology are discussed below. The general description of the development is presented in detail in Chapter 2 – Project Description.

The primary characteristics relating to surface water are;

- Potential impact of accidental leaks/spill during operation
- Impact on water quality due to run-off and wastewater discharge
- As the development is already built there can be no further impact re flooding.

6.5 POTENTIAL IMPACTS

The potential impacts of the activity at the existing NCCCL facility in Kanturk, Co. Cork on the hydrological environment are outlined in the following paragraphs.

6.5.1 Impacts on Surface Water Quality

The most significant risk to receiving water from the facility during operation is from stormwater and effluent discharge. The site is situated on the western bank of the River Allow which rises approximately 20km northwest of Kanturk, close to the border with County Limerick. The River Allow is designated within the River Blackwater (Cork/Waterford SAC) There are five stormwater discharge points and one foul to the River Allow from the facility. The main foul discharge point (SW-1) is the outfall from the on-site wastewater treatment plant (WWTP). Stormwater arising on site from areas of potential poor quality run-off are directed to sumps. The five remaining surface water emission points comprise stormwater surface discharge to the River Allow from individual areas of both roofs and hardstanding on the site.

6.5.2 Accidental leakage

A summary of the bulk liquid storage is provided below.

- Buttermilk storage tanks: 45000 l
- Raw milk storage silos (3 silos): 100,000 l, 100,000 l and 80,000 l
- Cream storage silos (3 silos): 35000 l and 30000 l x 2
- Milk storage tanks (3 tanks): 30,000 l, 16000 l and 12000 l
- Oil storage tank: 400,000 l
- Casein storage silos (6 silos): 250,000 l, 2 x 110,000l and 130,000l and 2 x 110,000l
- Milk storage silos (3 silos): 2 x 90,000l and 145,000l
- CIP tanks: 3 x 5000l dilute caustic (BioAtlantis)
- Heavy Fuel Oil (HFO) tank 100,000l (BioAtlantis)
- Seaweed extract tank: 5-10% solids: 2 x 110,000l (BioAtlantis)
- Concentrated extract tank: 50% solids: 2 x 30,000 l (BioAtlantis)
- Caustic tank and caustic wash recovery tank: 2 x 5,000 l
- Pressure vessel, 28,500 l and 30,000 l
- Potassium hydroxide tank 13000 l
- Milk silos: 3 x 5000 l
- CIP x 3, 1 water x 5000 l, caustic 5000 l, nitric acid 5000 l
- Detergent storage tank : 25000l
- CIP tank: 2 x 2000 litres (caustic and nitric),
- Crystallisation tanks (concentrated whey) - whey solids 60%: 3 x 25000l and 1 x 20000l

Accidental spillages which are not adequately mitigated may result in contamination of drainage channels and have an impact on the water quality of the Allow River. AWN has been advised that there have been no significant historical spillages at the site to date.

6.6 MITIGATION MEASURES

In order to minimise the potential impacts from the existing facility, the following mitigation measures will be implemented to minimise the impacts on the River Allow.

6.6.1 Management of Run-off

All process wastewater generated is directed to the on-site wastewater treatment plant (WWTP) prior to discharging to the River Allow at emission point SW-1 as shown on Insert 6.3 above. This includes process, cooling, Cleaning In Place (CIP) wastewater and a proportion of site stormwater which is delivered via underground pipe network directly to the WWTP. The WWTP receives the majority of stormwater from the site as several areas with potential poor run-off quality on site were bunded preventing rainfall in those source locations from discharging through stormwater drains to the River Allow.

The discharge to River Allow from the WWTP operates under a licence issued by Cork County Council (WP(W)09/11). This licence permits the facility to discharge 650 m^3/day (August to April) and 800m^3/day (May, June and July). Monitoring is ongoing to ensure compliance with licence conditions.

6.6.2 Accidental Spills and Leaks

Mitigation measures which should be implemented to minimise potential impacts include the following:

- The integrity of the CIP and detergent storage tanks should be tested regularly
- All fuel storage tanks are double skinned and/or suitably bunded
- An adequate supply of containment booms and/or suitable absorbent material (spill kits) are maintained on site at all times
- A visual inspection is completed every week during operations to ensure that there is no evidence of contamination around the storage tanks
- In the unlikely event of a spill or leak, any leachate shall be removed and deposited in a contaminated waste container and disposed of by licensed waste hauliers. In the event of an occurrence whose consequences have an effect on the environment it is important that, in the first instance it is brought to the attention of the Yard Supervisor. If the incident involves release of polluted matter to waters then the County Council and the Fisheries Board shall be informed immediately.

6.7 RESIDUAL IMPACTS

The residual impacts are those that would occur after the mitigation measures have taken effect.

The residual impacts relate to those impacts that would occur after the mitigation measures, as outlined in Section 6.6 above, have taken effect. In the case of the existing NCCL facility, the potential impact on surface water during operation (following EPA, 2002 assessment criteria) is considered to have a **Long term, Imperceptible to slight Impact, with a Neutral Impact on quality** i.e. an impact capable of measurement but without noticeable consequences.

REFERENCES

1. EPA Guidelines on the Information to be Contained in Environmental Impact Statements, Environmental Publications, Dublin 2, 2002

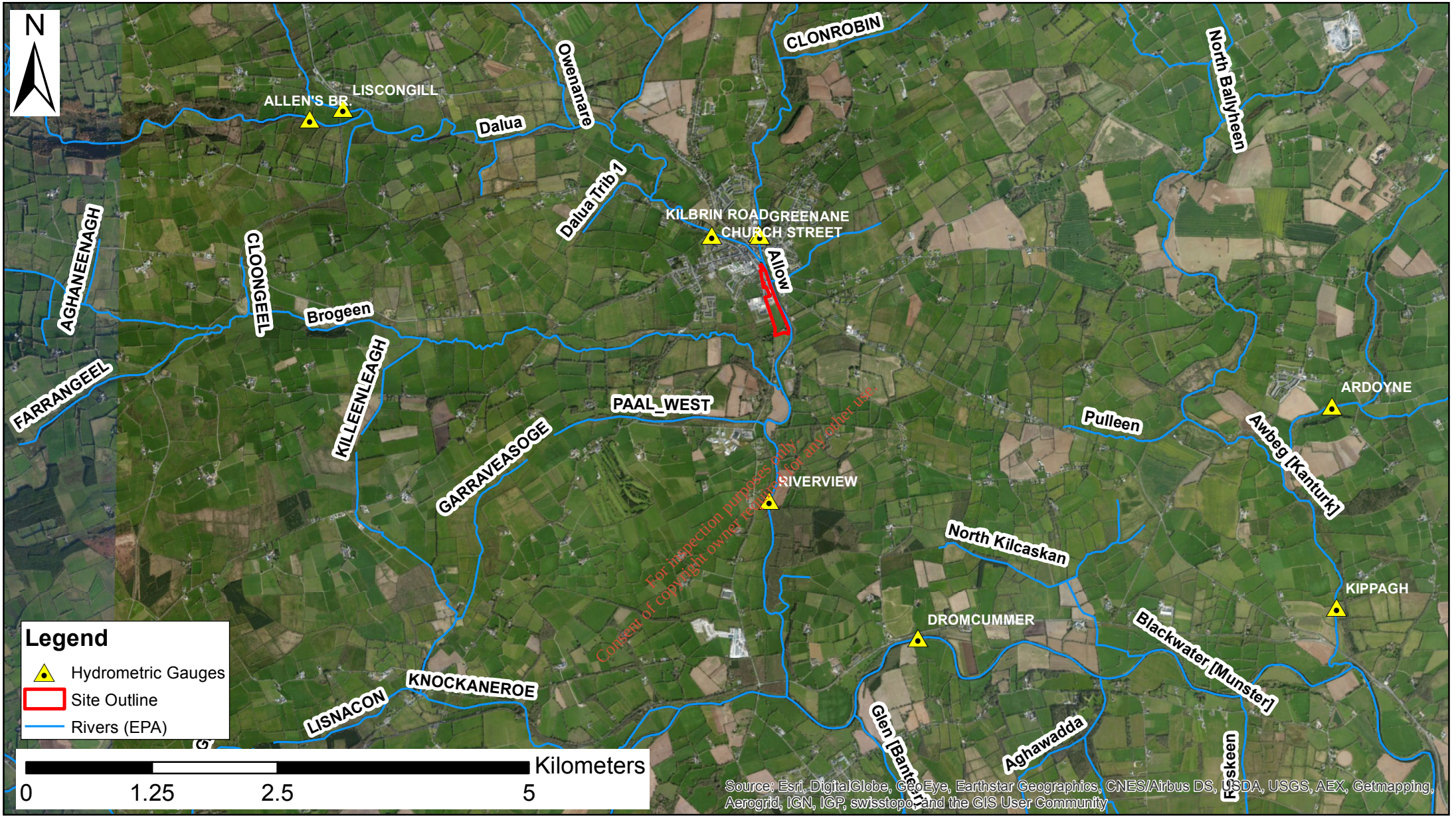
2. EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), Environmental Publications, Dublin 2, 2003

3. EPA (2002) Water Quality Database, Johnstown Castle Estate, Wexford

4. Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie, OPW

5. Geological Survey of Ireland, www.gsi.ie Online Groundwater Database

6. CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors.



Note: Drawing is for illustrative purposes only; Do not scale

AWN Consulting Ltd
The Tecpro Building,
Clonshaugh Business & Technology Park
Dublin 17,
Tel: + 353 1 847 4220
Fax: + 353 1 847 4257

CLIENT: North Cork Creameries	**PROJECT:** Environmental Impact Statement	**DRAWN:** G.W.	**CHECKED:** E.O.B	**APPROVED:** E.O.B	**APP'D DATE:** 18/10/2016
DRAWING TITLE: Regional Hydrology		**Figure 6.1**	No. of Sheets: 1	**SIZE:** A4	**SCALE:** 1:25,000
	PROJECT Ref: 16/9125	REVISION DESCRIPTION		SHEET	REV

APPENDIX 6.1

IMPACT RATINGS AND ASSESSMENT CRITERIA (WATER & HYDROLOGY)

Table 1 Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on hydrology attribute (NRA)

Magnitude of Impact	Criteria	Typical Examples*
Large Adverse	Results in loss of attribute and/ or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Calculated risk of serious pollution incident >1% annually[2]
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood Level >10mm[1]
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak *flood level*[1]
Minor Beneficial	Results in minor improvement of attribute quality	Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually[2]
Moderate Beneficial	Results in moderate improvement of attribute quality	Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually[2]
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm[1]

The NRA criterion for estimation of the importance of hydrological attributes at the site during the EIA stage are summarised in Table 3 below.

Table 2 Criteria for Rating Impact Significance of Hydrological Attributes (NRA)

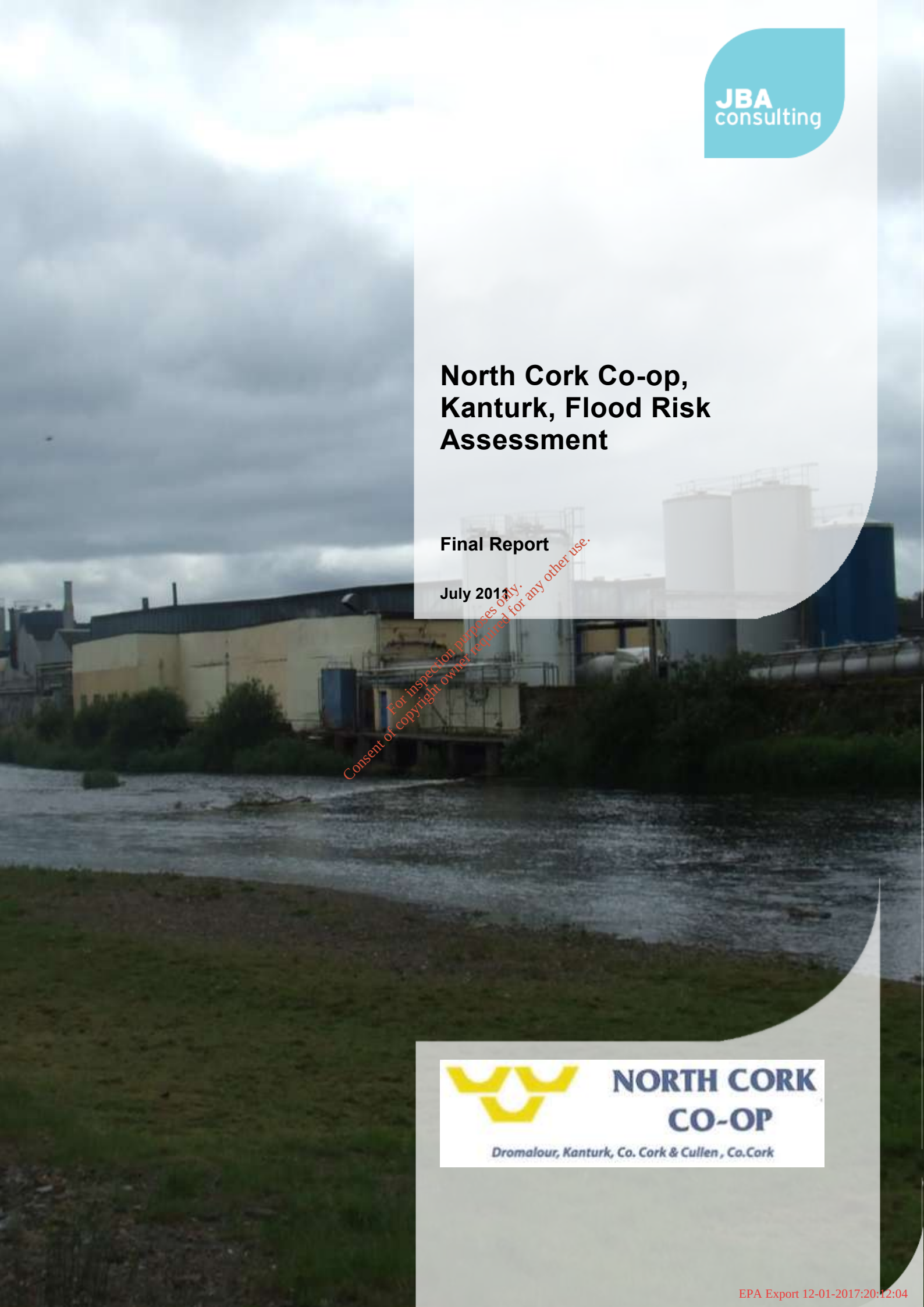
Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Table 3: Rating of Significant Environmental Impacts at EIS Stage (NRA)

Importance of Attribute	Magnitude of Importance			
	Neglible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

APPENDIX 6.2

FLOOD RISK ASSESSMENT (WATER & HYDROLOGY)



North Cork Co-op, Kanturk, Flood Risk Assessment

Final Report

July 2011

NORTH CORK CO-OP
Dromalour, Kanturk, Co. Cork & Cullen, Co.Cork

JBA Office

JBA Consulting
24 Grove Island
Corbally
Limerick
Ireland

JBA Project Manager

Ross Bryant

Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1 / July 2011		Andy MacSharry AdMAC Consulting
Final v1 / July 2011		Andy MacSharry AdMAC Consulting

Contract

This report describes work commissioned by Michael O'Shea, on behalf of North Cork Co-operative Creameries Ltd., by email dated 11 July 2011. North Cork Co-operative Creameries' representative for the contract was Andy MacSharry of AdMAC Consulting. Sarah Conroy and Ross Bryant of JBA Consulting carried out this work.

Prepared by ..... Sarah Conroy MEng CEng MIEI
Senior Engineer

Reviewed by ..... Ross Bryant BSc MSc CEnv MCIWEM C.WEM
Team Leader

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Purpose

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Flood Risk Assessment Summary Sheet

Site Name	North Cork Co-operative Creameries
Site Location	Kanturk
Site Description	Existing creameries facility
Proposed Development	Extension of existing casein plant to provide new milk evaporator and niro powder dryer building (22.5m x 6m). Defined as 'Minor proposals' by the Planning System and Flood Risk Management Guidelines for Planning Authorities.
Watercourses	Rivers Allow and Dalua. River Allow catchment area upstream of site is 264 km^2.
Land Use Vulnerability Class	Less vulnerable
Main Source of Flood Risk	Fluvial - River Allow
Flood Zone	Flood Zone B
Justification Test for Development Management	Not applicable, as minor development only (as defined in Section 5.28 of the Planning System and Flood Risk Management Guidelines for Planning Authorities).
Recommended Flood Mitigation Measures	Incorporation of flood risk management into the site's emergency plan. Inclusion of flood resilient finishes into the proposed extension works.
Conclusion	Development demonstrated to be suitable under the Planning System and Flood Risk Management Guidelines for Planning Authorities.

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Abbreviations

AEP	Annual Exceedance Probability
AMAX	Annual Maximum
BFI	Base Flow Index
DEHLG	Department of Environment, Heritage and Local Government
FFL	Finished Floor Level(s)
FRA	Flood Risk Assessment
FSR	Flood Studies Report
IPCC	Intergovernmental Panel on Climate Change
HEFS	High End Future Scenario (OPW scenario for climate change)
JBA	JBA Consulting Engineers & Scientists
LAP	Local Area Plan
LiDAR	Light Detection and Ranging
mOD	Metres above Ordnance Datum (Datum is Malin unless stated otherwise)
MRFS	Mid Range Future Scenario (OPW scenario for climate change)
NDP	National Development Plan
OPW	Office of Public Works
OSi	Ordnance Survey Ireland
QBAR	Mean Annual Flood
SRES	Special Report on Emissions Scenarios

1 Introduction

1.1 Terms of Reference

JBA Consulting was commissioned by North Cork Co-operative Creameries Ltd. to produce a Flood Risk Assessment (FRA) for a proposed extension to the existing creameries facility at Bluepool Lower, Kanturk, Co. Cork. The report was commissioned to provide additional information to accompany an existing planning application (Planning File no. 115351), which was submitted to Cork County Council on 21 June 2011.

1.2 Report Structure

The Planning System and Flood Risk Management - Guidelines for Planning Authorities, was published in November 2009 by the Office of Public Works (OPW) and the Department of Environment, Heritage and Local Government (DEHLG); JBA Consulting were the co-authors. The Guidelines recommend an appropriately detailed assessment of flood risk.

Section 1 of this report gives an overview of the study requirements and background information. Section 2 provides an introduction to the Planning Guidelines on which this report is based. The Flood Risk Assessment (FRA) is presented in Sections 3 and 4. Finally conclusions and recommendations are given in Section 5.

1.3 Technical Concepts

1.3.1 Presentation of Return Periods

Flood frequency can be defined in terms of a return period, which is the average time between years with at least one larger flood. Return periods are used because they are the generally accepted convention among hydrologists and engineers, and are used in the Flood Studies Report (FSR).

Flood frequency can alternatively be expressed in terms of an annual exceedance probability (AEP), which is the inverse of the return period, as shown in

Table 1-1, overleaf. This can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval, and is the terminology which will be used throughout this report.

Table 1-1 Conversion between return periods and annual exceedance probabilities

Return Period (years)	Annual exceedance probability (%)
2	50
10	10
25	4
75	1.33
100	1
200	0.5
1000	0.1

1.3.2 Climate Change

The Planning Guidelines recommend that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects. A significant amount of research into climate change has been undertaken on both a national and international front. This section will briefly examine some of the key findings of the research to date.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 and its first report in 1990 justified concern about the effects of climate change on a scientific basis. The

more recent IPCC Fourth Assessment Report 2007[1] concludes that climate change is unequivocal. It projects a global average sea level rise of between 0.18 m and 0.59 m for different SRES emissions scenarios, up to the end of the century. (SRES refers to the IPCC Special Report on Emissions Scenarios, published in 2000. The scenarios explore different demographic, economic and technological forces and resultant greenhouse gas emissions.)

More specific advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW draft guidance[2]. Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more extreme potential future scenario at the upper boundaries of projected future scenarios.

Based on these two scenarios the OPW recommended allowances for climate change are given in Table 1-2 below.

Table 1-2 Allowances for future scenarios (100 year time horizon)

Table 1: Allowances for Future Scenarios (100 year time horizon)

	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]
Urbanisation	*No General Allowance – Review on Case-by-Case Basis*	*No General Allowance – Review on Case-by-Case Basis*
Forestation	- 1/6 Tp[2]	- 1/3 Tp[2] + 10% SPR[3]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Note 2: Reduce the time to peak (Tp) by a third: This allows for potential accelerated runoff that may arise as a result of drainage of afforested land

Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for increased runoff rates that may arise following felling of forestry.

[1] Inter-Governmental Panel on Climate Change (IPCC), 4th assessment report. "Climate Change 2007".

[2] OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance, 2009

2 The Planning System and Flood Risk Management

2.1 Introduction

The Planning Guidelines give guidance on flood risk, its identification, assessment and management in areas of potential development. The Guidelines recommend a precautionary approach when considering flood risk management in the planning system. The core principle of the Guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding, as illustrated in Figure 2-1 and Table 2-1.

Figure 2-1 Indicative Flood Zones

Table 2-1 Definition of the flood zones

Zone	Description
Zone A High probability of flooding.	This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).
Zone B Moderate probability of flooding.	This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000).
Zone C Low probability of flooding.	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

Once a flood zone has been identified, the Guidelines set out the different types of development appropriate to each zone.

Exceptions to the restriction of development due to potential flood risks are provided for through the use of the Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centres that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.

2.2 Assessment of Minor Proposals in Areas of Flood Risk

Paragraph 5.28 of the Planning Guidelines deals with minor proposals, such as *'small extensions to houses, and most changes of use of existing buildings and or extensions and additions to existing commercial and industrial enterprises*'. The Guidelines state that such proposals are *'unlikely to raise significant flooding issues, unless they obstruct important flow paths, introduce a significant additional number of people into flood risk areas or entail the storage of hazardous substances*.' The Guidelines go on to explain that '*since such applications concern existing buildings, the sequential approach cannot be used to locate them in lower-risk areas and the Justification Test will not apply. However, a commensurate assessment of the risks of flooding should accompany such applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities. These proposals should follow best practice in the management of health and safety for users and residents of the proposal.*'

2.2.1 Minor Proposals at North Cork Co-operative Creameries

The proposed works at North Cork Co-operative Creameries fall under the definition of minor proposals, comprising a small extension to an existing commercial/industrial facility. The sequential approach and Justification Test therefore do not apply.

The aim of this FRA is to provide a *'commensurate assessment of the risks of flooding, to demonstrate that the development would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities'* at the North Cork Co-operative site, as required by the Planning Guidelines.

2.3 Stages of Flood Risk Assessment

A three staged approach to undertaking an FRA is recommended by the Planning Guidelines. In summary, the three stages are:

- ***Flood Risk Identification (Stage 1)*** - Identification of any issues relating to the site that will require further investigation through a Flood Risk Assessment. This stage makes use of existing and historical information.
- ***Initial Flood Risk Assessment (Stage 2)*** - Involves establishment of the sources of flooding, the extent of the flood risk, potential impacts of the development and possible mitigation measures.
- ***Detailed Flood Risk Assessment (Stage 3)*** - Assess flood risk issues in sufficient detail to provide quantitative appraisal of potential flood risk of the development, impacts of the flooding elsewhere and the effectiveness of any proposed mitigation measures.

The Guidelines recognise that *'all stages may not be needed to complete a flood risk assessment.'* The required level of detail *'will depend on the level of risk and the potential conflict with proposed development and the scale of mitigation measures being proposed.'*

2.4 Flood Risk Identification

To begin the process, an assessment of the potential for, and scale of flood risk at the site is conducted using existing and historical information. This identifies sources of potential flood risk to the site and, if any, highlights the need for further investigation through an Initial Flood Risk Assessment. The findings from the flood risk identification stage of the assessment are provided in Section 3 of this report.

2.5 Flood Risk Assessment

An initial FRA provides a broad scale assessment of the flood risk at the site. The Guidelines highlight a number of key items to be covered for a site specific FRA:

- Examination of all sources of flooding that may affect the plan area;
- Appraisal of the availability and adequacy of existing information;

- Identification of Flood Zones;
- Determine what technical studies are appropriate;
- Describe what residual risks will be assessed;
- Potential impacts of development on flooding elsewhere;
- Scope of possible mitigation measures.

The findings from this stage of the report can be found in Sections 3 and 4 of this document. This FRA report is considered appropriate and sufficient to allow an informed decision with respect to the proposed development on the grounds of flood risk.

3 Flood Risk Identification

3.1 Introduction

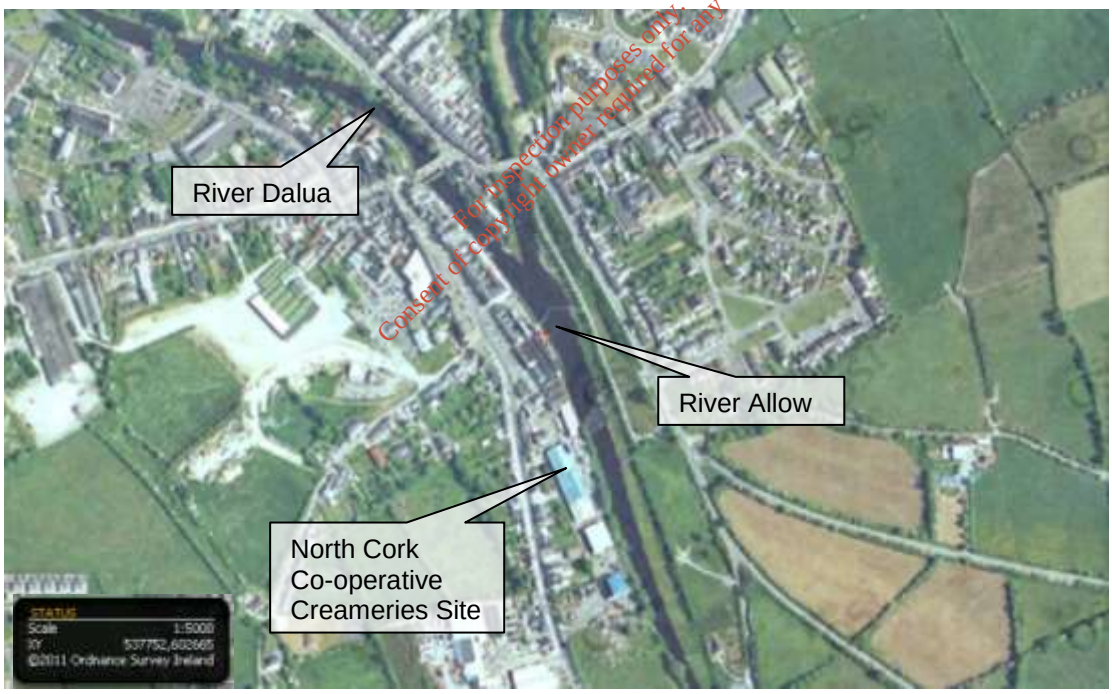
As discussed in Section 2, the Planning Guidelines require that proposed developments identify the potential and scale of any flood risk. This is important despite the minor nature of the proposed works. This section includes a description of the site location and topography, a review of historic flooding and identification of the sources and scale of flood risk issues.

3.2 Site Description

The proposed development site is the existing North Cork Co-operative Creameries facility at Bluepool Lower, Kanturk (Figure 3-1). It is located at the southern edge of Kanturk town, and is situated on the right (western) bank of the River Allow. The site is bounded to the north by existing residential and commercial development, to the east by the River Allow, to the south by open space, and to the west by existing residential/commercial development and Bluepool Lower road.

Existing ground levels at the site range from approximately 80.7 mOD Malin to 81.7 mOD Malin. The entire creameries site is hardcover.

Figure 3-1 Site Location



3.3 The Proposed Development

The proposed development comprises the following works (as detailed in Cork County Council Planning File no. 115351):

- partial demolition of, and alterations to existing casein plant bag store;
- construction of new evaporator/dryer building;
- erection of new cooling tower;
- all associated site works.

The new Milk Evaporator and Niro Powder Dryer building will measure 22.5m by 6m, and will have a Finished Floor Level (FFL) of 81.4 mOD Malin. The extension will not result in any increase in the area of hardcover at the site, and will not entail the storage of hazardous substances.

Figure 3-2 is a photograph of the existing casein plant building, showing the approximate location of the proposed new milk evaporator and niro powder dryer extension.

Figure 3-3 is an extract from the AdMAC Consulting site layout drawing (Drawing No. NCCP-11-05), showing the extension location within the site.

Figure 3-2 Existing Casein Plant building, showing approximate location of proposed extension

Figure 3-3 Extract from Site Layout Drawing showing location of proposed extension

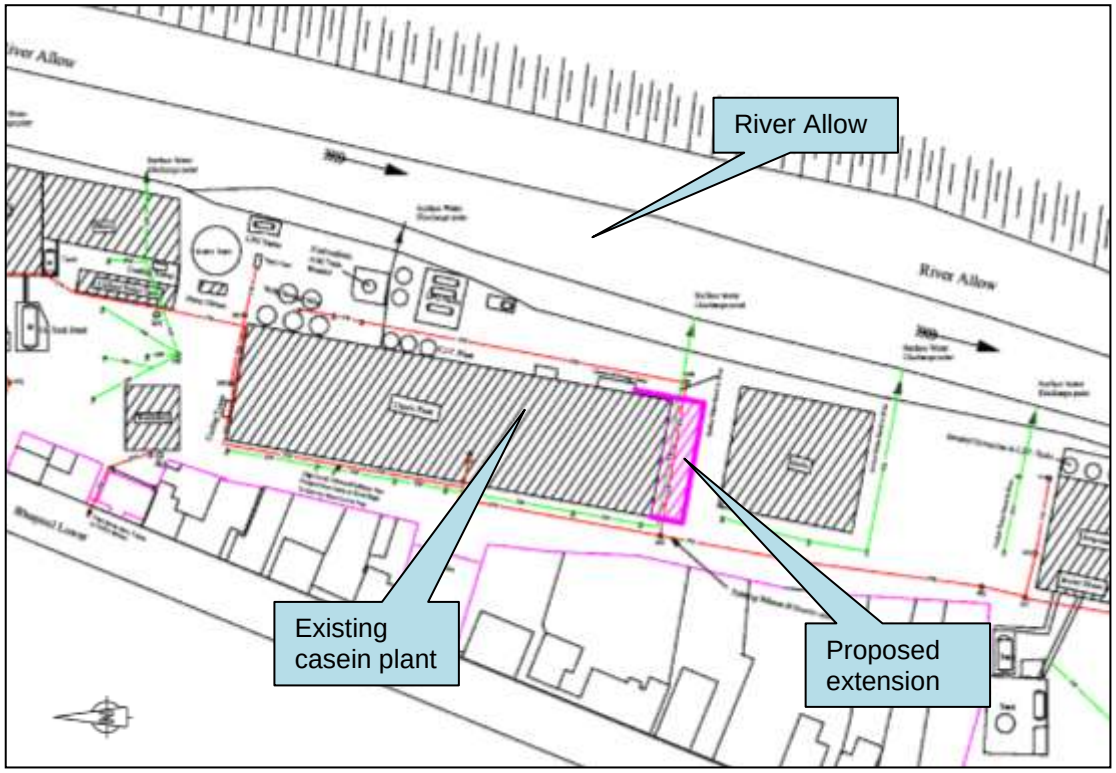
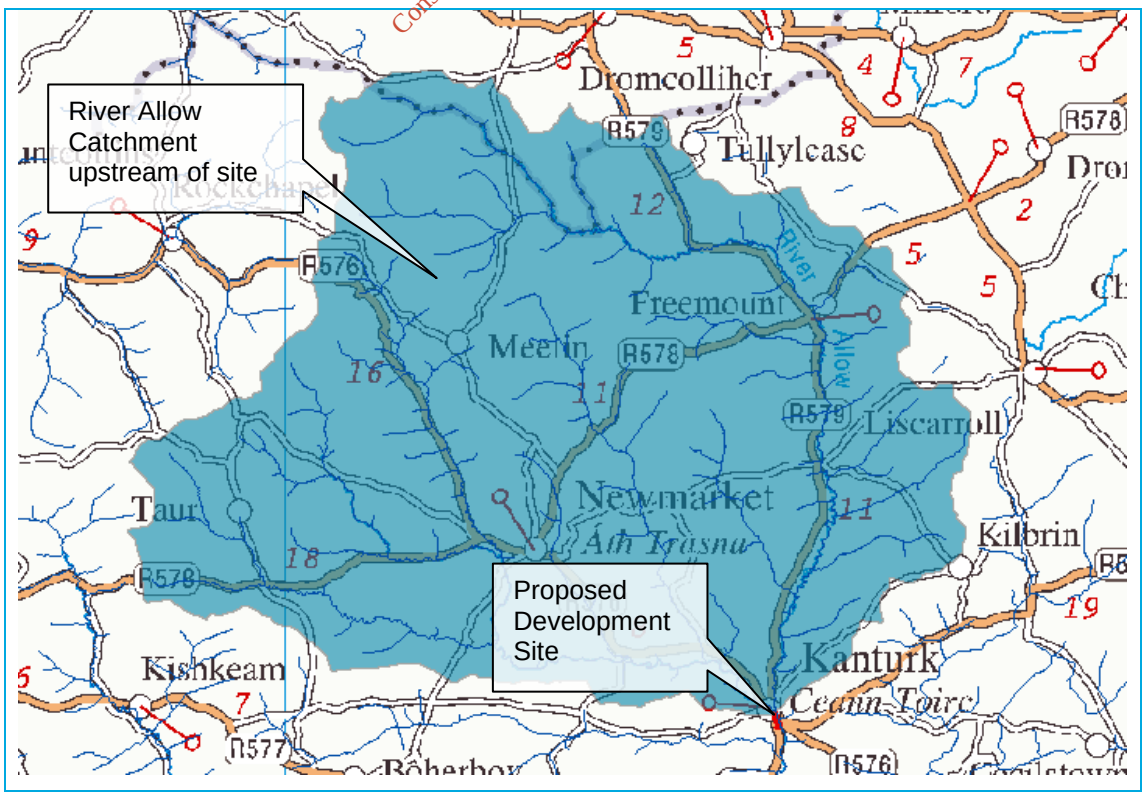


Figure 3-4 View south-west across River Allow to site (looking downstream)

3.4 Watercourses

The site lies within the catchment of the River Allow, which rises approximately 20km northwest of Kanturk, close to the border with County Limerick. A tributary of the River Allow, the River Dalua, flows into the River Allow in Kanturk town, a short distance (approximately 60 m) upstream of the site. The total catchment area of the River Allow upstream of the site is 264 km^2; the catchment is shown in Figure 3-5, below.

Figure 3-5 River Allow Catchment



Background Mapping: Ordnance Survey Ireland Licence No. AR 0107211
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3.5 Flood History

The OPW hosts a National Flood Hazard Mapping website[3], which highlights areas at risk of flooding through the collection of recorded data and observed flood events. The website has records of flooding in Kanturk, as shown in Figure 3-6, below, and summarised in Table 3-1.

Figure 3-6 Floodmaps.ie Extract

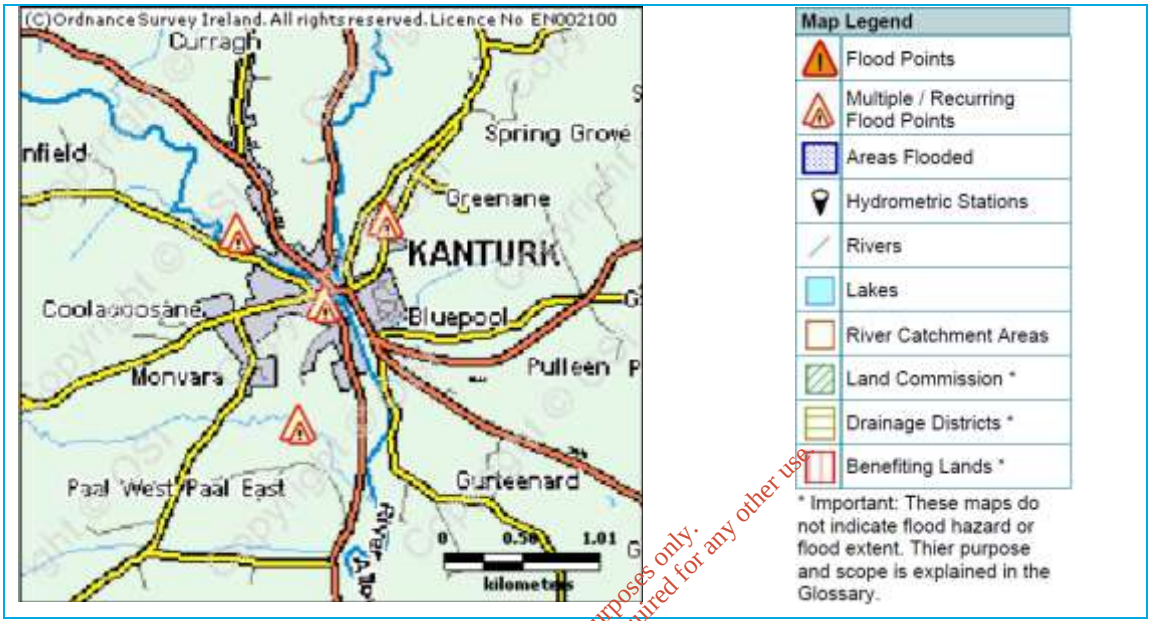


Table 3-1 Historic Flood Events Recorded on Floodmaps.ie

Date of Flood	Details
October 2004	Brogeen River
August 1986	Rivers Dalua and Allow, Kanturk
June 1982	River Dalua, Kanturk Park
November 1980	River Dalua, Kanturk
Recurring	River Dalua at Kanturk Town Park
Recurring	River Allow, R579 Strand Street, Kanturk
Recurring	Brogeen River
Recurring	Greenane, near Kanturk

3.6 Sources of Flooding

Stage 1 of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Sources of flooding considered at the proposed development are:

- Fluvial
- Pluvial

3.6.1 Fluvial

The Rivers Allow and Dalua are a significant source of flooding in Kanturk. The confluence of these rivers is a short distance (approximately 60m) upstream of the northern site boundary. The River Allow then flows in a southerly direction past the site, and is the primary source of flood risk to the site. Flooding in the vicinity of the site can occur when flows in the River Allow exceed channel capacity, causing the river to overtop its banks.

[3] www.floodmaps.ie

3.6.2 Pluvial

Pluvial flooding is the result of rainfall-generated overland flows which arise before runoff can enter any watercourse or sewer. It is usually associated with high intensity rainfall. Flood risk from pluvial sources exists in all areas.

The proposed works at the North Co-op Creameries site will not cause any increase in the area of hardcover, so will not cause any increase in runoff.

4 Flood Risk Assessment

4.1 Introduction

This section investigates potential flood zones, impacts and mitigation measures, in an appropriate level of detail.

Mapping showing indicative extents of Flood Zones A and B from Cork County Council's Kanturk Electoral Area Draft Local Area Plan (November 2010) has been used to identify areas at risk of flooding.

4.2 Kanturk LAP Flood Zone Mapping

Cork County Council is compiling a series of indicative maps showing areas that could be at risk from flooding across the county. Areas close to recognised settlements have been prioritised, and flood risk information for these areas has been provided through the publication of the draft Local Area Plans.

The Kanturk Electoral Area Draft Local Area Plan includes draft indicative flood extent mapping for Flood Zones A and B (as required by the Planning Guidelines and discussed in Section 2 of this report). This flood extent mapping has been prepared by Cork County Council from an amalgamation of the following sources:

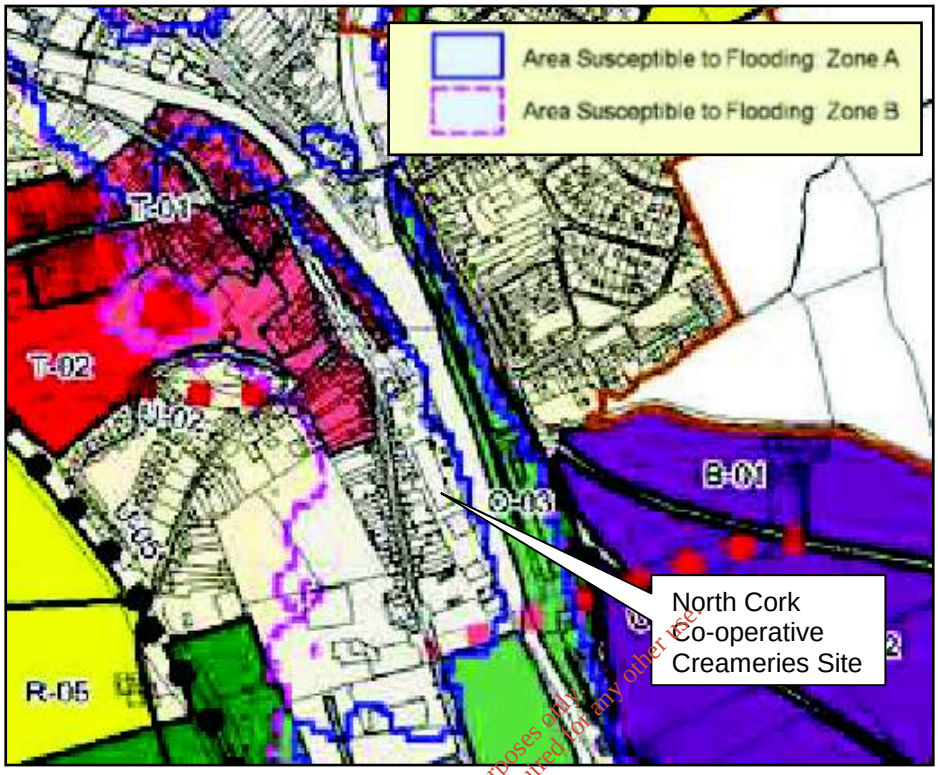
- Floodmaps.ie - historical flood event information from the OPW's national flood hazard mapping website.
- JBA Consulting flood mapping - These indicative flood extent maps provide predictive flood extent information for river catchments where a more detailed Catchment Flood Risk Assessment and Management (CFRAM) study is not currently available.

4.2.1 Development Flood Risk Zone

An extract from the draft LAP zoning map for Kanturk showing the vicinity of the site is reproduced in Figure 4-1, overleaf. Indicative flood extents for Flood Zones A and B are shown.

The map indicates that the North Cork Co-op Creameries site lies in Flood Zone B - moderate probability of flooding (0.1% to 1% AEP). The land use vulnerability of the development is classed as 'less vulnerable' by the Planning Guidelines.

Figure 4-1 Extract from Draft Kanturk LAP Zoning Map, showing Indicative Flood Zones A and B



4.3 Potential Impacts of Development on Flooding

When assessing the elements of flood risk at the site, the potential impacts of the development on flooding in the surrounding area must also be taken into account. Paragraph 5.28 of the Planning Guidelines states that FRAs for minor proposals must demonstrate that the development will not have 'adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities.'

4.3.1 Impacts on Fluvial Flooding

The site is located adjacent to the River Allow; however, the proposed extension works will not impede access to the watercourse or floodplain. There are no flood protection or management facilities in the immediate vicinity of the site, so the proposed development will have no adverse effects in this regard.

The size of the proposed extension is approximately 6m x 22.5m (i.e. 135 m^2). In the context of the floodplain of the River Allow, this is an exceptionally small area. The extension is not designed to be water-tight and therefore the effect on floodplain storage will be negligible. The proposed works will not affect flow paths during a flood event, as the extension is not located in an area of active conveyance of flood flows.

4.3.2 Impacts on Pluvial Flooding

As described in Section 3.6.2, the proposed works will not result in any increase in area of hardcover at the site, so there will be no increase in surface water runoff.

4.4 Climate Change

OPW guidelines on climate change require that the effect of a 20% increase in river flow be considered. The 0.1% AEP flood extent (Flood Zone B) provides a greater increase in flow than this 20% value. The Flood Zone B extent may therefore be deemed to include allowance for climate change.

4.5 Scope of Mitigation Measures

The scale of the proposed extension works is small, and the proposed works will not introduce a significant additional number of people into the area of flood risk; nor will the building be used for the storage of hazardous materials. Minor mitigation measures are proposed here, to ensure that the effects of a potential flood event at the site on people and property are minimised:

- Incorporate flood resilient finishes (such as tiled floors and walls, and raised electrical points) into the proposed extension works to ensure the consequences of any inundation can be managed and recovery can be delivered quickly in the event a flood occurs;
- Incorporate flood risk management into the emergency plan for the site, including flood evacuation routes, emergency contact details, roles and responsibilities in the event of a flood and general flood advice. The plan should be made available to all employees at the site to ensure awareness of flood risk and the predefined emergency procedures.

5 Conclusions and Recommendations

5.1 Conclusions

This Flood Risk Assessment has found that although the site is located in Flood Zone B, (moderate probability of flooding), the proposed works are of a minor nature, as defined in paragraph 5.28 of the Planning Guidelines, *'Assessment of minor proposals in areas of flood risk,'* and the land use is classified as less vulnerable to flooding. As such, the sequential approach and Justification Test do not apply: the North Cork Co-operative Creameries facility already exists, and cannot be located outside the floodplain.

We note the following findings with respect to flood risk and the proposed development:

- The proposed works will not introduce a significant additional number of people into the area of flood risk, as the extension is very small in relation to the existing Creameries facility;
- The new building will not be used for the storage of hazardous materials;
- The works will not impede access to the watercourse, floodplain or any flood protection or management facilities;
- The footprint of the extension is small (approximately 135m^2), the building is not designed to be watertight, and is not located in an area of active conveyance of flood flows. The effect on floodplain storage and flood levels will therefore be negligible;
- The extension will not impact on flow paths in the surrounding area;
- The works will not cause any increase in the area of hardcover at the site, so there will be no increase in surface water runoff.

5.2 Recommendations

- Incorporation of flood risk management into the site's emergency plan.
- Inclusion of flood resilient finishes into the proposed extension works.

Registered Office

24 Grove Island
Corbally
Limerick
Ireland

T: +353 (0) 61 345463
e: info@jbaconsulting.ie

JBA Consulting Engineers and Scientists Limited

Registration number 444752

Visit our website
www.jbaconsulting.ie

7.0 FLORA & FAUNA

7.1 INTRODUCTION

This chapter provides an assessment of the impacts of the development in question on the ecological environment, i.e. flora and fauna. It has been compiled in compliance with the European Communities Legal requirements and follows Guidelines on the Information to be contained in Environmental Impact Statements (Environmental Protection Agency, 2002) and Advice Notes on Current Practice in the preparation of EIS (2003).

7.2 METHODOLOGY

This section of the EIS concentrates on ecological features within the development area of particular significance, primarily designated habitats and species. This includes habitats/species listed in Annex I, II and IV of the EU Habitats Directive, rare plants listed in the Flora Protection Order and other semi-natural habitats of conservational value.

The European Habitats Directive 92/43/EEC (Article 6) indicates the need for plans and projects to be subject to Habitats Directive Assessment (also known as Appropriate Assessment) if the plan or project is not directly connected with or necessary to the management of a Natura 2000 site (which includes SACs and SPAs) but has the potential to have implications on a site's conservation objectives. These implications can be significant effects either individually or in combination with other plans or projects.

The information gathered in this chapter is formed from the basis of an Appropriate Assessment Natura Impact Statement Report which is presented as Appendix B6(f2) of the IED licence application for which this EIS has been prepared. This report was compiled by Ecofact Environmental Consultants in August 2011.

7.2.1 POLICY & GUIDANCE

EU Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union and lists certain habitats and species that must be protected within wildlife conservation areas, considered to be important at a European as well as at a national level. A "Special Conservation Area" or SAC is a designation under the Habitats Directive. The Habitats Directive sets out the protocol for the protection and management of SACs.

The Directive sets out key elements of the system of protection including the requirement for "Appropriate Assessment" of plans and projects. The requirements for an Appropriate Assessment are set out in the EU Habitats Directive. Articles 6(3) and 6(4) of the Directive

Birds Directive

The "Birds Directive" (Council Directive 79/409/EEC as amended 2009/147/EC) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. This directive identifies species that are rare,

in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). Appendix I indicates Annex I bird species as listed on the Birds Directive. A “Special Protection Area” or SPA, is a designation under The Birds Directive.

Special Areas of Conservation and Special Protection Areas form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires appropriate assessment.

Wildlife Acts (1976 - 2012)

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976. The aims of the wildlife act according to the National Parks and Wildlife Service are “to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims”. All bird species are protected under the act. The Wildlife (Amendment) Act of 2000 amended the original Act to improve the effectiveness of the Act to achieve its aims. The Wildlife (Amendment) Act of 2012 amended the 2010 Act with regard to hunting.

Desk Study

The assessment was carried out in two stages, firstly through desktop assessment to determine existing records in relation to habitats and species present in the study area. This included research on the NPWS metadata website and a literature review of published information on flora and fauna occurring in the development area.

The second part of the assessment involves an evaluation of the development area and determination of the potential impacts on the flora and fauna of the area. This part of the assessment forms the basis for a Natura Impact Statement and is based on the following guidelines and publications:

- EPA Advice Notes on Current Practice (EPA, 2003)
- Assessment of plans and projects significantly affecting Natura 2000 sites (EC, 2002)
- Managing Natura 2000 Sites (EC, 2000) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2007)
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, Rev. Feb. 2010)

The following resources assisted in the production of this section of the report:

- Ordnance Survey Ireland maps
- OSI, Google and Bing Aerial photography
- National Parks and Wildlife Service (NPWS) Mapviewer:
  http://www.npws.ie/en/MapsData/
  Designated sites (SACs, SPAs, NHAs)
  Records of protected species from 10km squares
- National Biodiversity Data Centre data: http://www.biodiversityireland.ie/
- National Biodiversity Plan

7.3 RECEIVING ENVIRONMENT

The following is a description of the flora and fauna of the existing environment in the study area.

7.3.1 Designated Conservation Areas

The location of the NCCCL facility is shown in Figure 7.1.

The site is located on the west bank of the River Allow. The River Allow is designated within the River Blackwater (Cork/Waterford SAC) as it supports populations of Annex II freshwater pearl mussels, Atlantic salmon and lamprey species, as well as the Annex I habitat 'floating river vegetation', listed on the EU Habitats Directive (1992). The Kanturk creamery site is located on the bank of the River Allow and a portion of the site along the riparian corridor lies within the designated SAC boundary. It is considered that the Natura 2000 site boundary follows the historical 6 inch mapping field boundaries along the river corridor and therefore has not taken account of the presence of the creamery facility at this location. It is not expected that the creamery yard and portions of the processing plant would be included for designation within this SAC.

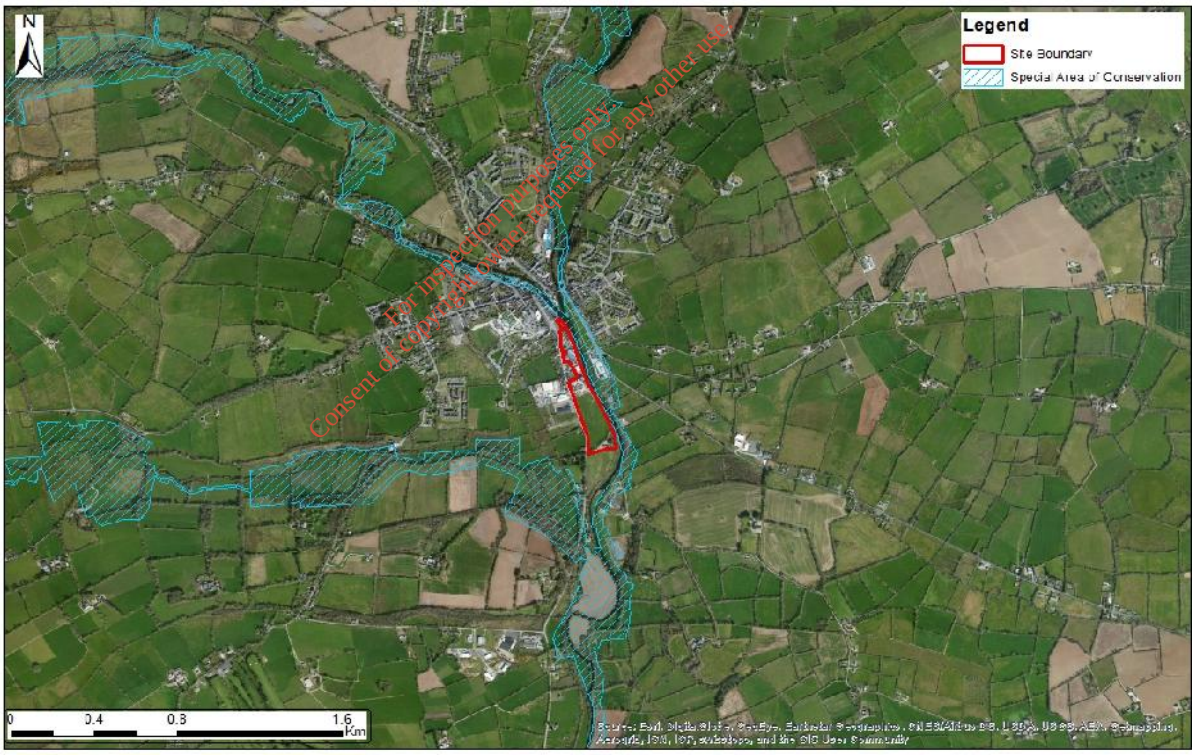


Figure 7.1 showing locations of designated conservation areas around the NCC facility

7.3.2 Non-Designated Areas

The predominant habitat in the development area is Buildings and Artificial Surfaces (BL3). The River Allow adjacent to the existing creamery is an eroding watercourse (FW1), the riparian corridor is dominated by the non-native Himalayan balsam *(Impatiens glandulifera*) with an established stand of Japanese knotweed recorded on the bank of the site boundary. A habitat map is not presented as there will be no change to the existing development. All site activities will continue to take place in

the existing buildings and hard stand areas. These are visible in the most recent aerial photo presented in Figure 7.2.

Figure 7.2 Showing habitats in the development area circled.

7.3.3 MAMMALS

Given the existing artificial habitat on site and the fact that the site is an operational facility, there is no potential for mammals on site.

7.3.4 BIRDS

All birds are protected under the Wildlife Acts. Again, given the working nature of the existing environment, there is limited habitat available for birds.

7.3.5 HABITAT EVALUATION

The ecological value of the site was assessed following the guidelines set out in the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (2006) according to the Natura Scheme for evaluating ecological sites (after Nairn & Fossitt, 2004). Judgements on the evaluation were made using geographic frames of reference, e.g. European, National, Regional or Local.

The Screening Assessment carried out by Ecofact in 2011 identified the Natura 2000 sites within a 15km radius of the NCCCL site. Only two sites were identified, the River Blackwater SAC (site code 02170) and the Stacks to Mullaghareirks, West Limerick Hills and Mount Eagle SPA (site code 04161).

The Blackwater River SAC designation includes the aquatic habitats and riparian corridor of the River Blackwater (Cork/Waterford) and its major tributaries including the River Allow which flows directly adjacent to the facility. The SAC designation boundary on the River Allow includes the aquatic habitats and the riparian corridor. A portion of the NCCCL site along the riparian corridor lies within the designated SAC boundary.

The Stacks to Mullaghareirks, West Limerick Hills and Mount Eagle SPA is located approximately 15 kilometres north west of the site at Kanturk. There are no pathways, either geographical or hydrological by which the existing facility may adversely affect this designated Natura 2000 site; it is therefore not considered further in this assessment.

Field Studies

Macroinvertebrate kick-sampling was undertaken at three stations on the River Allow by Ecofact aquatic ecologists in 2011. Full details of the study are included in the Appropriate Assessment report attached as Appendix B.6(f2). These sites were located downstream of the existing discharge from the NCCCL site, adjacent to the existing site and upstream of the NCCCL site, directly downstream of the confluence of the Allow and Dalua Rivers.

Site 1

This site was located approximately 50m downstream of the discharge from the NCCCL facility effluent treatment plant discharge. The river at this location had a mix of substrate types, flow features with some pool habitat recorded. This site was considered to be sub-optimal/ optimal in terms of habitats for macroinvertebrates.

Site 2

This site was located adjacent to the NCCCL facility. The substrate at this site was mostly of bedrock and was considered sub-optimal with reference to macroinvertebrate production. A rich macroinvertebrate assemblage was recorded with 24 different macroinvertebrate families occurring.

Site 3

The site was located upstream of NCCCL. This site was immediately downstream of a small weir. The right hand side of the river (looking in a downstream direction) was deemed to be influenced by the Dalua River and the left hand side by the Allow River. Macroinvertebrates in 24 different families were recorded at this location by sampling along the width of the river downstream of a weir. Macroinvertebrate habitat was considered optimal to sub-optimal.

7.4 CHARACTERISTICS OF THE DEVELOPMENT

North Cork Creamery proposes to make an application for an EPA Industrial Emissions Directive (IED) Licence. It is not proposed to make any changes to existing natural environment at the existing facility.

7.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

7.5.1 Impacts On Habitats

The NCCCL facility at Kanturk is located directly adjacent to the River Blackwater (Cork/Waterford) SAC site boundary on the River Allow. This site designation includes the riparian corridor of the River Allow and includes in part the boundary of the existing creamery site.

Direct habitat loss affecting the Annex I conservation interests of the SAC is considered unlikely. However there is potential for direct impacts arising from the existing facility with regard to discharges from the onsite waste water treatment plant and surface water run-off occurring directly adjacent to and within the boundary of

the designated site affecting water quality which is a key indicator of conservation value of the SAC. Assessment of the current licenced discharge (Chapter 6 and Appropriate Assessment) has shown that the discharge is not impacting on the current water quality status and as such the habitat requirements of the water body.

A worst case scenario would occur if the development were to impact water quality in terms of an accidental release of contaminated surface water/process effluent discharge where the water quality of the River Allow adjacent to the facility would be affected which could result in impacts on the habitat requirements for the Allow and the River Blackwater SAC.

7.5.2 IMPACTS ON FAUNA

There is no potential for impact on fauna as it is not proposed to make any changes to the existing environment at the facility.

7.6 REMEDIAL AND MITIGATION MEASURES

The following measures are recommended:

- Contaminated stormwater run-off and process water is discharged to the wastewater treatment plant. The discharge from the treatment plant is monitored to ensure its compliance with the licence requirements.

- In the event of an occurrence whose consequences have an effect on the environment it is important that, in the first instance it is brought to the attention of the Yard Supervisor. If the incident involves release of polluted matter to waters then the County Council and the Fisheries Board shall be informed immediately.

- Integrity of all storage tanks should be tested regularly and all fuel storage tanks should be double skinned and/or suitably bunded.

- An adequate supply of containment booms and/or suitable absorbent material (spill kits) are maintained on site at all times

- A visual inspection is completed every week during operations to ensure that there is no evidence of contamination around the storage tanks

- In the unlikely event of a spill or leak, any leachate shall be removed and deposited in a contaminated waste container and disposed of by licensed waste hauliers.

- Any below ground waste or process lines should be regularly tested for integrity.

7.7 PREDICTED IMPACT OF THE DEVELOPMENT

Impacts arising from the existing development at the NCCCL site on the Blackwater SAC have been identified as being limited to potential water quality impacts should the wastewater treatment not comply with licence requirements or due to an accidental spill discharging to surface water run-off without mitigation. Such an impact could potentially affecting the water dependent Annex II qualifying interests of the River Black Water SAC i.e. Atlantic salmon, freshwater pearl mussel, otter and brook lamprey as well as the Annex I 'floating river vegetation'.

Current assessment as summarized under Chapter 6 Surface Water and the Appropriate Assessment show there is no evidence of current impact on water quality which could impact on the SAC habitat requirements. A licence for WWTP discharge is currently in place and will be maintained under the operation of an EPA licence at the site. In addition the implementation of an EPA licence and operation of an EMS will ensure management of surfacewater runoff quality in the future.

The existing facility adjacent to the SAC boundary is not likely to result in any habitat loss or degradation with respect to the terrestrial Annex I habitat for which the site is designated.

8.0 REFERENCES

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Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).

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8.0 AIR QUALITY AND CLIMATE

8.1 INTRODUCTION

AWN Consulting Ltd has been commissioned to carry out an air dispersion modelling study of emissions from the North Cork Creameries facility, Kanturk, Co. Cork. The modelling assessment will form part of the EIS.

The purpose of this modelling study is to determine whether the emissions from the site will lead to ambient concentrations which are in compliance with the relevant ambient air quality standards for NO_2, CO, SO_2, odour and PM_{10} / $PM_{2.5}$ and to identify the location and maximum of the worst-case ground level concentrations for each compound assessed. Odour emissions from the BioAtlantis facility on site will also be modelled and compared against limit values.

This report describes the outcome of this study. The study consists of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Summary of background NO_2, CO, SO_2 and PM_{10} / $PM_{2.5}$ levels;
- Dispersion modelling of NO_2, CO, SO_2, odour and PM_{10} / $PM_{2.5}$ under a Do-Nothing and Do-Something emission scenario;
- Presentation of predicted ground level concentrations of released substances under a Do-Nothing and Do-Something emission scenario;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

Information supporting the conclusions has been detailed in the following sections. The assessment methodology and study inputs are presented in Section 8.2. The dispersion modelling results and assessment summaries are presented in Section 8.3. The model formulation is detailed in Appendix 8.1, a review of the meteorological data used is detailed in Appendix 8.2 whilst detailed meteorological data is presented in Appendix 8.3.

8.2 METHODOLOGY

Emissions from the facility have been modelled using the AERMOD dispersion model (Version 15181) which has been developed by the U.S. Environmental Protection Agency (USEPA)[1] and following guidance issued by the EPA[2]. The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources and has replaced ISCST3[3] as the regulatory model by the USEPA for modelling emissions from industrial sources in both flat and rolling terrain[4-6]. The model has more advanced algorithms and gives better agreement with monitoring data in extensive validation studies[7-11]. An overview of the AERMOD dispersion model is outlined in Appendix 8.1.

The air dispersion modelling input data consisted of information on the physical environment (including building dimensions and terrain features), design details from all emission points on-site and five years of appropriate hourly meteorological data. Using this input data the model predicted ambient ground level concentrations beyond the site boundary for each hour of the modelled meteorological years. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. This worst-case concentration was then added to the background concentration to give the worst-case predicted environmental concentration (PEC). The PEC was then compared with the relevant ambient air quality standard to assess the significance of the releases from the site.

Throughout this study a worst-case approach was taken. This will most likely lead to an over-estimation of the levels that will arise in practice. The worst-case assumptions are outlined below:

- Maximum predicted concentrations were reported in this study, even if no residential receptors were near the location of this maximum;
- Worst-case background concentrations were used to assess the baseline levels of substances released from the site;
- The effects of building downwash, due to on-site and any nearby off-site buildings, has been included in the model;
- Worst-case operations for NO_2, CO, SO_2, Odour and PM_{10} / $PM_{2.5}$ emissions assumes all emission points are running for 24 hours a day for a set number of days per year;
- Modelling assumed that all emission points were running at the IED emission concentration and maximum volume flow

8.2.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health- or environmental-based levels for which additional factors may be considered. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC (see **Table** 8-1). The ambient air quality standards applicable for NO_2,SO_2 and PM_{10} / $PM_{2.5}$ are outlined in this Directive.

These standards have been used in the current assessment to determine the potential impact of NO_2, SO_2 and PM_{10} / $PM_{2.5}$ emissions from the proposed facility on air quality.

Pollutant	Regulation [Note 1]	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
		Annual limit for protection of human health	40 µg/m^3 NO_2
		critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m^3
		Annual & Winter critical level for the protection of ecosystems	20 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
		Annual limit for protection of human health	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)[Note 2]	-	Annual limit for protection of human health	20 µg/m^3 $PM_{2.5}$
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - 'Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'.

Table 8-1 Air Quality Standards 2011 (Based on Directive 2008/50/EC)

8.2.2 Air Dispersion Modelling Methodology

The United States Environmental Protection Agency (USEPA) approved AERMOD dispersion model has been used to predict the ground level concentrations (GLC) of compounds emitted from the principal emission sources on-site.

The modelling incorporated the following features:

- Two receptor grids were created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grids were based on Cartesian grids with the site at the centre. An outer grid extended to 10,000 m with the site at the centre and with concentrations calculated at 250 intervals. A smaller denser grid extended to 1225 m from

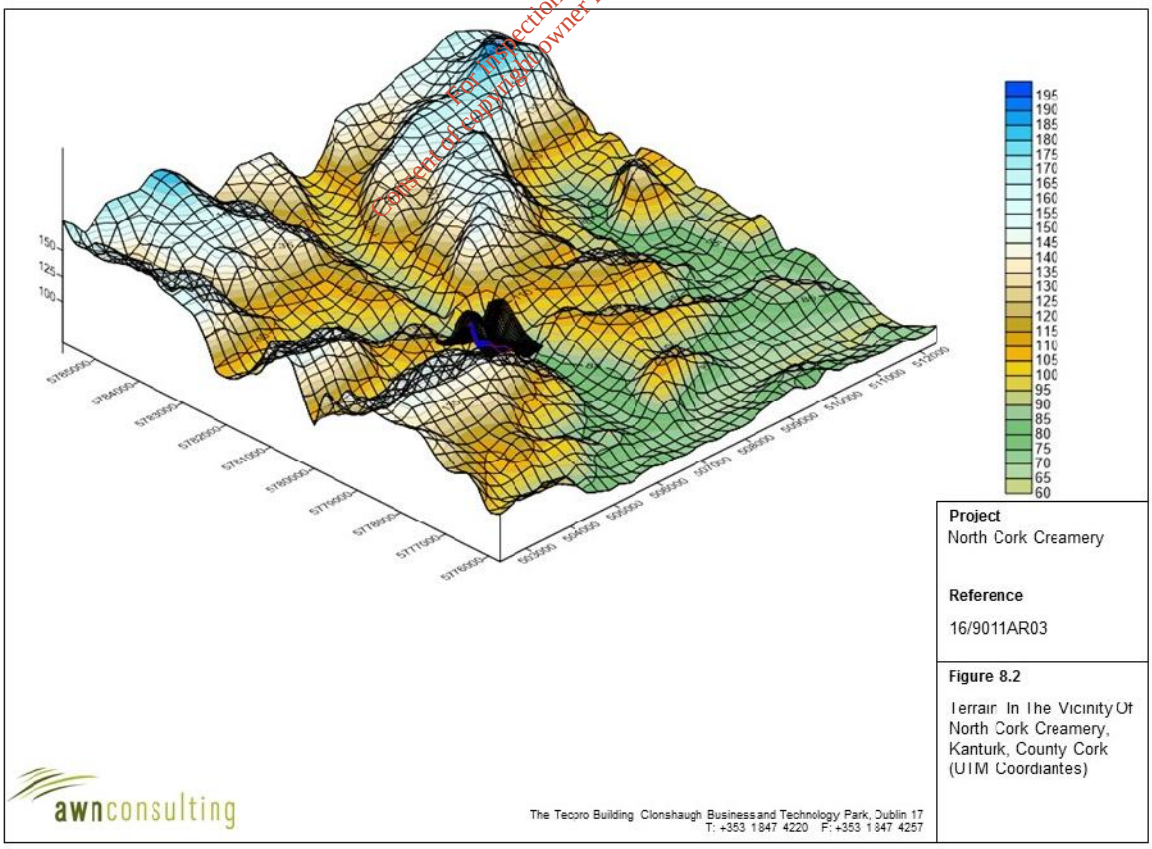
the site with concentrations calculated at 25 m intervals. Boundary receptor locations were also placed along the boundary of the site, at 25 m intervals. All receptors have been modelled at 1.8 m to represent breathing height.

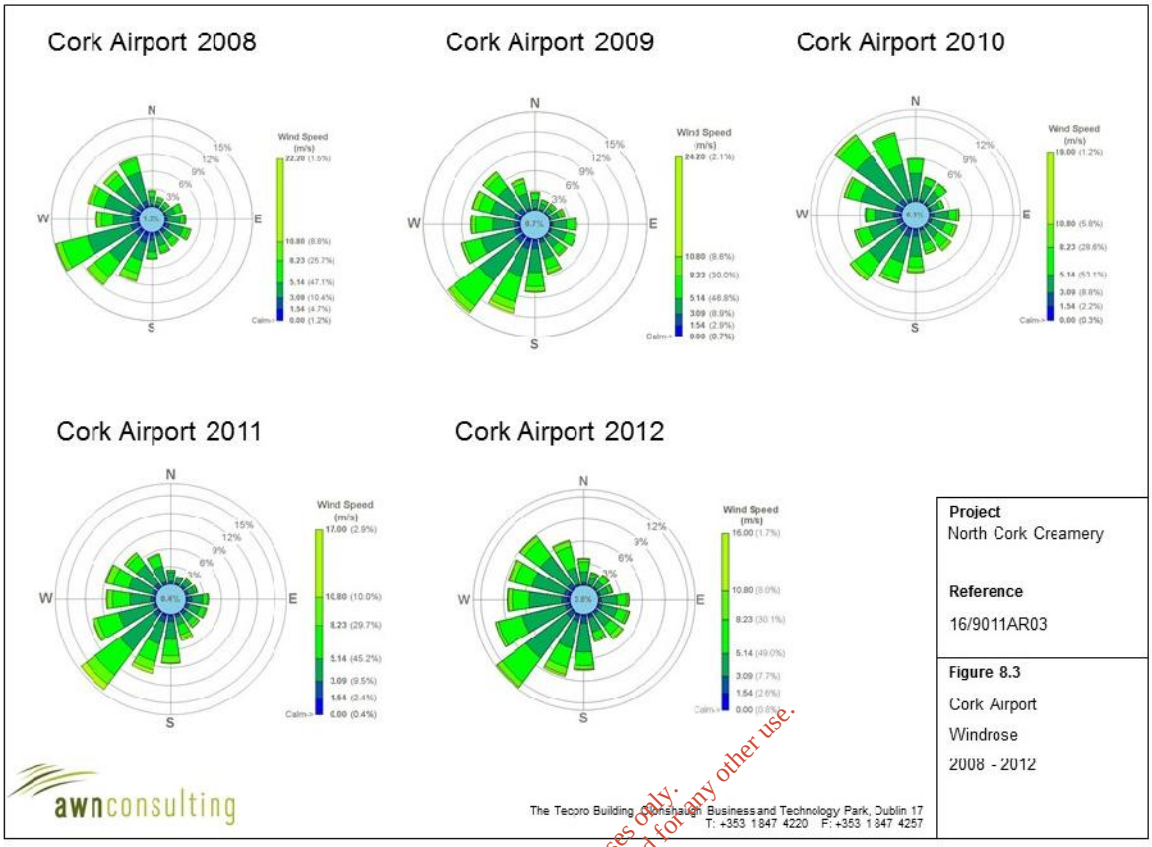
- All on-site buildings and significant process structures were mapped into the computer to create a three dimensional visualisation of the site and its emission points. Buildings and process structures can influence the passage of airflow over the emission stacks and draw plumes down towards the ground (termed building downwash). The stacks themselves can influence airflow in the same way as buildings by causing low pressure regions behind them (termed stack tip downwash). Both building and stack tip downwash were incorporated into the modelling.

- Detailed terrain has been mapped into the model using SRTM data with 30m resolution. The site is located in complex terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP[18] as shown in Figure 8.2.

- Hourly-sequenced meteorological information has been used in the model. Meteorological data over a five-year period (Cork Airport, 2008 – 2012) was used in the model (see Figure 8.3 and Appendix 8.3).

- The source and emission data, including stack dimensions, gas volumes and emission temperatures have been incorporated into the model.





8.2.3 Terrain

The AERMOD air dispersion model has a terrain pre-processor AERMAP[18] which was used to map the physical environment in detail over the receptor grid. The digital terrain input data used in the AERMAP pre-processor was obtained from SRTM. This data was run to obtain for each receptor point the terrain height and the terrain height scale. The terrain height scale is used in AERMOD to calculate the critical dividing streamline height, H_{crit}, for each receptor. The terrain height scale is derived from the Digital Elevation Model (DEM) files in AERMAP by computing the relief height of the DEM point relative to the height of the receptor and determining the slope. If the slope is less than 10%, the program goes to the next DEM point. If the slope is 10% or greater, the controlling hill height is updated if it is higher than the stored hill height.

In areas of complex terrain, AERMOD models the impact of terrain using the concept of the dividing streamline (H_c). As outlined in the AERMOD model formulation[2] a plume embedded in the flow below H_c tends to remain horizontal; it might go around the hill or impact on it. A plume above H_c will ride over the hill. Associated with this is a tendency for the plume to be depressed toward the terrain surface, for the flow to speed up, and for vertical turbulent intensities to increase.

AERMOD model formulation states that the model “captures the effect of flow above and below the dividing streamline by weighting the plume concentration associated with two possible extreme states of the boundary layer (horizontal plume and terrain-following). The relative weighting of the two states depends on: 1) the degree of atmospheric stability; 2) the wind speed; and 3) the plume height relative to terrain. In stable conditions, the horizontal plume "dominates" and is given greater weight while in neutral and unstable conditions, the plume traveling over the terrain is more heavily weighted”[1].

The terrain in the region of the facility is complex in the sense that the maximum terrain in the modelling domain peaks at 190 m which is above the stack top of all emission points onsite. However, in general, as shown in Figure 8.2, the region of the site has moderately sloping terrain particularly in the immediate vicinity of the facility.

8.2.4 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA[4]. A primary requirement is that the data used should have a data capture of greater than 90% for all parameters. Cork Airport meteorological station, which is located approximately 45 km south-east of the site, collects data in the correct format and has a data collection of greater than 90%. Long-term hourly observations at Cork Airport meteorological station provide an indication of the prevailing wind conditions for the region (see Figure 8.3 and Appendix 8.3). Results indicate that the prevailing wind direction is from south to north-westerly in direction over the period 2008 - 2012. The mean wind speed is approximately 5.4 m/s over the period 1981-2010. Calm conditions account for only a small fraction of the time in any one year peaking at 105 hours in 2008 (1.2% of the time). The number of missing hours are also very low with an average of 11 missing hours / year over the period 2008 – 2012 (0.1% of the time).

8.2.5 Geophysical Considerations

AERMOD simulates the dispersion process using planetary boundary layer (PBL) scaling theory[1]. PBL depth and the dispersion of pollutants within this layer are influenced by specific surface characteristics such as surface roughness, albedo and the availability of surface moisture. Surface roughness is a measure of the aerodynamic roughness of the surface and is related to the height of the roughness element. Albedo is a measure of the reflectivity of the surface whilst the Bowen ratio is a measure of the availability of surface moisture.

AERMOD incorporates a meteorological pre-processor AERMET[19] to enable the calculation of the appropriate parameters. The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and albedo and to a distance of 1km for surface roughness in line with USEPA recommendations[19,20] as outlined in Appendix 8.2.

In relation to AERMOD, detailed guidance for calculating the relevant surface parameters has been published[20]. The most pertinent features are:

- The surface characteristics should be those of the meteorological site (Cork Airport) rather than the installation;
- Surface roughness should use a default 1km radius upwind of the meteorological tower and should be based on an inverse-distance weighted geometric mean. If land use varies around the site, the land use should be sub-divided by sectors with a minimum sector size of 30º;
- Bowen ratio and albedo should be based on a 10km grid. The Bowen ratio should be based on an un-weighted geometric mean. The albedo should be based on a simple un-weighted arithmetic mean.

AERMOD has an associated pre-processor, AERSURFACE[20], which has representative values for these parameters depending on land use type. The AERSURFACE pre-processor currently only accepts NLCD92 land use data which covers the USA. Thus, manual input of surface parameters is necessary when modelling in Ireland. Ordnance survey discovery maps (1:50,000) and digital maps such as those provided by the EPA, National Parks and Wildlife Service (NPWS) and Google Earth® are useful in determining the relevant land use in the region of the meteorological station. The Alaska Department of Environmental Conservation has issued a guidance note for the manual calculation of geometric mean for surface roughness and Bowen ratio for use in AERMET[21]. This approach has been applied to the current site with full details provided in Appendix 8.2.

8.2.6 Building Downwash

When modelling emissions from an industrial installation, stacks which are relatively short can be subjected to additional turbulence due to the presence of nearby buildings. Buildings are considered nearby if they are within five times the lesser of the building height or maximum projected building width (but not greater than 800m).

The USEPA has defined the "Good Engineering Practice" (GEP) stack height as the building height plus 1.5 times the lesser of the building height or maximum projected building width. It is generally considered unlikely that building downwash will occur when stacks are at or greater than GEP[22].

When stacks are less than this height, building downwash will tend to occur. As the wind approaches a building it is forced upwards and around the building leading to the formation of turbulent eddies. In the lee of the building these eddies will lead to downward mixing (reduced plume centreline and reduced plume rise) and the creation of a cavity zone (near wake) where re-circulation of the air can occur. Plumes released from short stacks may be entrained in this airflow leading to higher ground level concentrations than in the absence of the building.

The Plume Rise Model Enhancements (PRIME)[8,9] plume rise and building downwash algorithms, which calculates the impact of buildings on plume rise and dispersion, have been incorporated into AERMOD. The building input processor BPIP-PRIME produces the parameters which are required in order to run PRIME. The model takes into account the position of each stack relative to each relevant building and the projected shape of each building for 36 wind directions (at 10º intervals). The model determines the change in plume centreline location with downwind distance based on the slope of the mean streamlines and coupled to a numerical plume rise model[10].

Given that most stacks onsite are less than 2.5 times the lesser of the building height or maximum projected building width, building downwash will need to be taken into account and the PRIME algorithm run prior to modelling with AERMOD. Shown in Figure 8.4 is an example of the dominant building (in blue) which is influencing the building downwash for stack A1-1. The dominant building may change as the wind direction changes for each of the 36 wind directions. The dominant building for each relevant stack will vary as a function of wind direction and relative building heights.

8.2.7 Characteristics of Odour

Odours are sensations resulting from the reception of a stimulus by the olfactory sensory system, which consists of two separate subsystems: the olfactory epithelium and the trigeminal nerve. The olfactory epithelium, located in the nose, is capable of detecting and discriminating between many thousands of different odours and can

detect some of them in concentrations lower than those detectable by currently available analytical instruments[24]. The function of the trigeminal nerve is to trigger a reflex action that produces a painful sensation. It can initiate protective reflexes such as sneezing to interrupt inhalation. The olfactory system is extremely complex and peoples' responses to odours can be variable. This variability is the result of differences in the ability to detect odour; subjective acceptance or rejection of an odour due to past experience; circumstances under which the odour is detected and the age, health and attitudes of the human receptor.

Odour Intensity and Threshold

Odour intensity is a measure of the strength of the odour sensation and is related to the odour concentration. The odour threshold refers to the minimum concentration of an odorant that produces an olfactory response or sensation. This threshold is normally determined by an odour panel consisting of a specified number of people, and the numerical result is typically expressed as occurring when 50% of the panel correctly detect the odour. This odour threshold is given a value of one odour unit and is expressed as 1 OU_E/m^3. The odour threshold is not a precisely determined value, but depends on the sensitivity of the odour panellists and the method of presenting the odour stimulus to the panellists. An odour detection threshold relates to the minimum odorant concentration required to perceive the existence of the stimulus, whereas an odour recognition threshold relates to the minimum odorant concentration required to recognise the character of the stimulus. Typically, the recognition threshold exceeds the detection threshold by a factor of 2 to 10[25,26].

Odour Character

The character of an odour distinguishes it from another odour of equal intensity. Odours are characterised on the basis of odour descriptor terms (e.g. putrid, fishy, fruity etc.). Odour character is evaluated by comparison with other odours, either directly or through the use of descriptor words.

Hedonic Tone

The hedonic tone of an odour relates to its pleasantness or unpleasantness. When an odour is evaluated in the laboratory for its hedonic tone in the neutral context of an olfactometric presentation, the panellist is exposed to a stimulus of controlled intensity and duration. The degree of pleasantness or unpleasantness is determined by each panellist's experience and emotional associations. The responses among panellists may vary depending on odour character; an odour pleasant to many may be declared highly unpleasant by some.

Adaptation

Adaptation, or Olfactory Fatigue, is a phenomenon that occurs when people with a normal sense of smell experience a decrease in perceived intensity of an odour if the stimulus is received continually. Adaptation to a specific odorant typically does not interfere with the ability of a person to detect other odours. Another phenomenon known as habituation or occupational anosmia occurs when a worker in an industrial situation experiences a long-term exposure and develops a higher threshold tolerance to the odour.

8.2.8 Odour Guidelines

The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour. By definition, 1 OU_E/m^3 is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference (the selection criteria result in the qualified panel being more sensitive to a particular odorant than the general population). The recognition threshold is generally about five times this concentration (5 OU_E/m^3) and the concentration at which the odour may be considered a nuisance is between 5 and 10 OU_E/m^3 based on hydrogen sulphide (H_2S)[26]. Clarkson and Misslebrook[27] proposed that a "faint odour" was an acceptable threshold criterion for the assessment of odour as a nuisance. Historically, it has been generally accepted that odour concentrations of between 5 and 10 OU_E/m^3 would give rise to a faint odour only, and that only a distinct odour (concentration of >10 OU_E/m^3) could give rise to a nuisance[28]. However, this criterion has generally been based on waste water treatment plants where the source of the odour is generally hydrogen sulphide. In 1990, a survey of the populations surrounding 200 industrial odour sources in the Netherlands showed that there were no justifiable complaints when 98%ile compliance with an odour exposure standard of a "faint odour" (5-10 OU_E/m^3) was achieved[29].

DEFRA[30,31] in the UK has published detailed guidance on appropriate odour threshold levels based in part on the offensiveness of the odour. The BioAtlantis facility in Kanturk is a specialist seaweed extraction facility. The BioAtlantis processes include the receipt of seaweed, the washing and chopping of seaweed, the storage of seaweed and the drying of seaweed. There are no directly comparable industrial sources in Table 8-2, however due to the type of processes a ranking of high in terms of pleasantness has been selected.

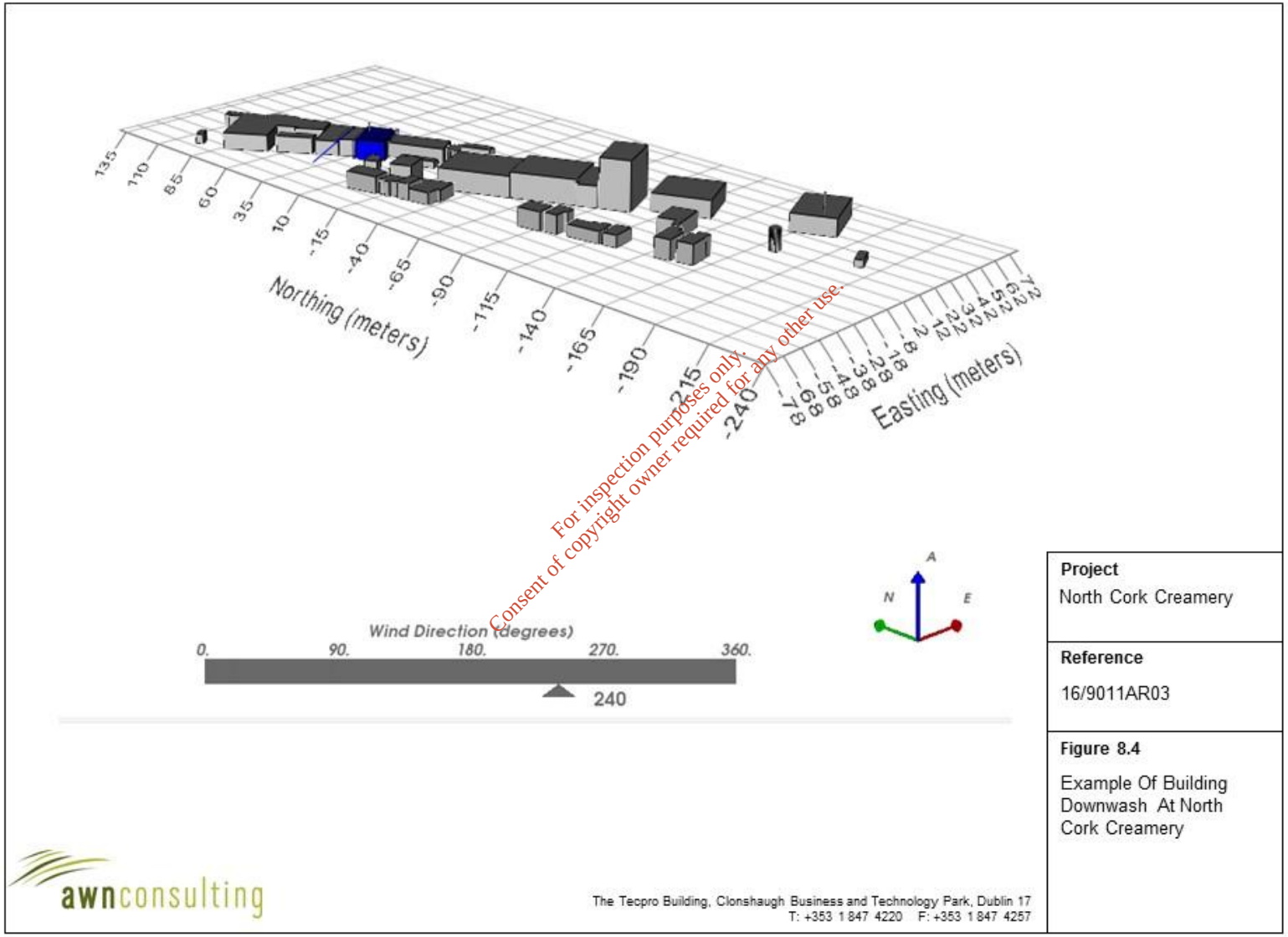
DEFRA has also detailed installation-specific exposure criteria based on the "annoyance potential"[30] which is defined as "the likelihood that a specific odorous mixture will give reasonable cause for annoyance in an exposed population". Industrial sources have been ranked into three categories based on their relative offensiveness which are "low", "medium" and "high" and exposure criteria assigned to each category (as shown in Table 8-3). The relevant exposure criteria vary from 1.5 OU_E/m^3 for highly odorous sources to 6.0 OU_E/m^3 for the least offensive odours. Due to the potential offensiveness of the onsite odours, which is ranked as high, the worst case exposure criteria for the facility is used. This is an odour exposure criteria of 1.5 OU_E/m^3 which is expressed as a 98th%ile and based on one hour means over a one-year period.

Environmental Odour Industrial Source	Ranking UK Median	Ranking UK Mean	Ranking Dutch Mean
Bread Factory	1	2.5	1.7
Coffee Roaster	2	3.9	4.6
Chocolate Factory	3	4.6	5.1
Beer Brewery	6	7.7	8.1
Fragrance & Flavour Factory	8	8.5	9.8
Charcoal Production	8	9.2	9.4
Green Fraction composting	9	10.3	14
Fish smoking	9	10.5	9.8
Frozen Chips production	10	11	9.6
Sugar Factory	11	11.3	9.8
Car Paint Shop	12	11.7	9.8
Livestock odours	12	12.6	12.8
Asphalt	13	12.7	11.2
Livestock Feed Factory	15	14.2	13.2
Oil Refinery	14	14.3	13.2
Car Park Bldg	15	14.4	8.3
Wastewater Treatment	17	16.1	12.9
Fat & Grease Processing	18	17.3	15.7
Creamery/milk products	10	17.7	-
Pet Food Manufacture	19	17.7	-
Brickworks (burning rubber)	18	17.8	-
Slaughter House	19	18.3	17.0
Landfill	20	18.5	14.1

Table 8-2 Ranking Table For Various Industrial Sources[30]

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion
Rendering Fish Processing Oil Refining Creamery WWTP Fat & Grease Processing	High	1.5 OU_E/m^3 as a 98^{th}%ile of hourly averages at the worst-case sensitive receptor
Intensive Livestock Rearing Food Processing (Fat Frying) Paint-spraying Operations Asphalt Manufacture	Medium	3.0 OU_E/m^3 as a 98^{th}%ile of hourly averages at the worst-case sensitive receptor
Brewery Coffee Roasting Bakery Chocolate Manufacturing Fragrance & Flavouring	Low	6.0 OU_E/m^3 as a 98^{th}%ile of hourly averages at the worst-case sensitive receptor

Table 8-3 Indicative Odour Standards Based On Offensiveness Of Odour[30]



Project
North Cork Creamery

Reference
16/9011AR03

Figure 8.4
Example Of Building Downwash At North Cork Creamery

awnconsulting
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257

8.3 RECEIVING ENVIRONMENT

8.3.1 Background Concentrations of Pollutants

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities[16,17]. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2015"[17], details the range and scope of monitoring undertaken throughout Ireland. As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes[16]. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, the area of the facility is categorised as Zone D[18].

NO_2 monitoring was carried out at two rural Zone D locations in 2015, Emo and Kilkitt and in two urban areas, Enniscorthy and Castlebar[17]. The NO_2 annual average in 2015 for both rural sites was 2.5 µg/m^3 with the results for urban stations averaging 8.5v µg/m^3. Hence long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m^3. The average results over the last five years at a range of urban Zone D locations suggests an upper average of no more than 11 µg/m^3 as a background concentration as shown in Table 8-4. Based on the above information a conservative estimate of the background NO_2 concentration in the region of the facility is 11 µg/m^3.

Year	Enniscorthy	Kilkitt	Emo	Castlebar
2011	-	3	-	8
2012	-	4	-	8
2013	-	4	4	11
2014	13	3	3	8
2015	9	2	3	8
Average	11	3.2	3.3	8.6

Table 8-4 Annual Mean NO_2 Concentrations In Zone D Locations 2011 - 2015 (µg/m^3)

Long-term PM_{10} monitoring was carried out at the urban Zone D locations of Castlebar, Kilkitt, Enniscorthy and Claremorris in 2015[17]. The maximum 24-hour concentration (as a 90th%ile) at each of the Zone D locations is shown in **Error! Reference source not found.**. The long-term average of the 90th%ile of 24-hour concentration is 24.4 µg/m^3. The average annual mean concentrations measured is 13.4 µg/m^3[17]. The average results over the last five years at a range of Zone D locations suggests an upper average of 13.4 µg/m^3 as a background concentration as shown in Table 8-6. Based on the above information a conservative estimate of the background PM_{10} concentration in the region of Kanturk is 13.4 µg/m^3.

Year	**Claremorris**	**Kilkitt**	**Eniscorthy**	**Castlebar**
2011	20.3	17.9	-	26.7
2012	17.7	15.9	-	19.8
2013	21	18.6	-	26.9
2014	15.2	15.4	37.35	20.95
Average	**18.6**	**17.3**	**37.4**	**24.4**

Table 8-5 90th%ile of 24-Hour PM_{10} Concentrations In Zone D Locations 2011 - 2014 (µg/m^3)
Note: 2015 data files are not yet available

Year	Claremorris	Kilkitt	Enniscorthy	Castlebar
2011	12	9	-	14
2012	10	9	-	12
2013	13	11	-	15
2014	10	9	22	12
2015	10	9	18	13
Average	11.0	9.4	20.0	13.2

Table 8-6 Annual Mean PM_{10} Concentrations In Zone D Locations 2011 - 2015 ($\mu g/m^3$)

The results of $PM_{2.5}$ monitoring at Claremorris (Zone D) in 2015[17] indicated an average $PM_{2.5}/PM_{10}$ ratio of 0.6. Based on this information, a conservative ratio of 0.6 was used to generate a rural background $PM_{2.5}$ concentration of 8 $\mu g/m^3$.

SO_2 concentrations for the representative rural Zone D monitoring stations at Kilkitt between 2010 and 2015 are on average 6.6 $\mu g/m^3$ for the 99.2nd%ile of 24-hour mean (limit value = 125 $\mu g/m^3$). The 1-hour limit value for SO_2 (measured as a 99.7th%ile) was 10 $\mu g/m^3$, which is significantly below the 350 $\mu g/m^3$ limit value.

CO concentrations for the representative rural Zone D monitoring stations are between 2011 and 2015 on average 2.4 mg/m^3 for the 8-hour value. This is significantly below the 10 mg/m^3 limit value.

In relation to the annual averages, the ambient background concentration is added directly to the process concentration. However, in relation to the short-term peaks, concentrations due to emissions from elevated sources cannot be combined in the same way. Guidance from the UK DEFRA[23] and the EPA[2] advises that for PM_{10} and SO_2 an estimate of the maximum combined pollutant concentration can be obtained as shown below:

PM_{10} - The 90.4th%ile of total 24-hour mean PM_{10} is equal to the maximum of either A or B below:

a) 90.4th%ile of 24-hour mean background PM_{10} + annual mean process contribution PM_{10}

b) 90.4th%ile 24-hour mean process contribution PM_{10} + annual mean background PM_{10}

SO_2 - The 99.7th%ile of total 1-hour mean SO_2 is equal to the maximum of either A or B below:

a) 90.4th%ile of hourly mean SO_2+ (2 x annual mean process concentration SO_2)

a) 90.4th%ile 24-hour mean process contribution SO_2 + (2 x annual mean background concentration SO_2)

SO_2 - The 99.2th%ile of total 24-hour mean SO_2 is equal to the maximum of either A or B below:

a) 99.2th%ile of 24-hour mean background SO_2 + (2 x annual mean process concentration SO_2)
b) 99.2th%ile 24-hour mean process contribution SO_2 + (2 x annual mean background concentration SO_2)

Nitrogen oxides (NO_X), containing both nitrogen oxide (NO) and nitrogen dioxide (NO_2) are emitted from the various combustion processes on-site, although it is the latter which is considered the more harmful to human health. These combustion processes lead to emissions which are mainly in the form of nitrogen oxide (NO) (typically 95%) with small amounts of the more harmful nitrogen dioxide.

NO_2 has been modelled following the approach outlined by the USEPA for assessing the impact of NO_X from point sources. The approach involves assessing the air quality impact through a three tiered screening technique. The initial analysis, termed the Tier 1 approach, assumes a worst-case scenario that there is total conversion of NO_X to NO_2. The guidance indicates that if this worst-case assumption leads to an exceedance of the appropriate limit value, the user should proceed to the next Tier. Tier 2 is appropriate for estimating the annual average NO_2 concentration, though not for estimating the maximum one-hour limit value. The Tier 2 approach indicates that the annual average concentration should be derived from an empirically derived NO_2/NO_X ratio. The guidance suggests that the NO_2/NO_X ratio should be based on data representative of area wide quasi-equilibrium conditions. In order to determine the maximum one-hour value, the Tier 3 approach is recommended by the USEPA. The Tier 3 approach involves the application of a detailed screening method on a case-by-case basis. The suggested methodologies include the ozone-limiting method or a site-specific NO_2/NO_X ratio. The site-specific method requires ambient monitors to be sited to obtain the NO_2 and NO_X concentrations under quasi-equilibrium conditions. In the current assessment, no site-specific continuous monitoring station is available. However, data from similar facilities indicates that long-term annual mean ratios are typically in the region of 0.6 for the NO_2/NO_x ratio whilst the short-term peak ratio (1-hr mean) is typically in the region of 0.25 NO_2/NO_x.

In relation to the annual averages, the ambient background concentration was added directly to the process concentration with the short-term peaks calculated using the equations above.

8.4 CHARACTERISTICS OF THE DEVELOPMENT

The current process assessment is based on current facility emissions, which will determine the emissions and degree of building downwash experienced by the existing major emission points. An assessment of a changeover to LPG fuel and a single boiler system from the current kerosene system has been undertaken. The information used in the dispersion model for the existing and proposed fuels is shown in **Error! Reference source not found.**– 8-9. It is assumed that the main boiler (A1-2) will run continuously on an LPG fuel. Boiler A1-3 will become a backup boiler running for 2 hours a day once a week for 4 months.

Process emissions from the BioAtlantis odour emission point vary depending on the process. During the pressure release of the alkaline extraction pressure vessel which, occurs for approximately one hour per day, the odour emission concentration increases significantly. For this reason, an increased concentration is modelled for a single hour per day, this is shown in brackets in **Error! Reference source not found.**.

Stack Reference	UTM (Zone 29N) Stack Location	Exit Diameter (m)	Height Above Ground Level (m)	Days per Year in Operation
A1-2	506644, 5780531	0.70	22	Continuous
A1-3	506700, 5780321	0.84	16.4	4
A2-1	506658, 5780446	0.75	24.4	300
A2-2	506681, 5780403	0.92	5.4	300
A2-3 (BioAtlantis)	506719, 5780334	6.0	5.4	Continuous
A3-1	506659, 5780443	0.25	10.5	300

Table 8-7 Stack Release Points Used In The Air Modelling

Stack Reference	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temperature (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_2 Concentration (mg/Nm^3)	NO_2 Mass Emission (g/s)	SO_2 Concentration (mg/Nm^3)	SO_2 Mass Emission (g/s)	PM_{10} / $PM_{2.5}$ Concentration (mg/Nm^3)	PM_{10} / $PM_{2.5}$ Mass Emission (g/s)
A1-1	0.70	0.38	461.15	5,402	12.90	751.5	1.1	1538.2	2.31	505.3	0.758
A1-2	0.70	0.38	442.15	5,229	6.11	686.6	1.0	1479.4	2.15	469.7	0.682
A1-3	0.84	0.55	456.15	10,612	8.88	756.5	2.2	1640.2	4.83	687.1	2.03
A2-1	0.8	0.4	321.2	17,970	13.28	-	-	-	-	37.1	0.185
A2-2	0.9	0.7	331.2	37,802	19.03	-	-	-	-	87.2	0.916
A2-3 (BioAtlantis)	0.6	0.3	Ambient	2,674	2.77	-	-	-	-	-	-
A3-3	0.8	0.3	289.2	2,822	16.90	-	-	-	-	0.8	0.001
Stack Reference	**Exit Diameter (m)**	**Cross-Sectional Area (m2)**	**Temperature (K)**	**Max Volume Flow (Nm^3/hr)**	**Exit Velocity (m/sec actual)**	**CO Concentration (mg/Nm^3)**	**CO Mass Emission (g/s)**	**Odour Concentration (OU_E/s)**	**Odour Mass Emission (OU_E/s)**		
A1-1	0.70	0.38	461.15	5,402	12.90	11.75	0.018	-	-		
A1-2	0.70	0.38	442.15	5,229	6.11	12.92	0.019	-	-		
A1-3	0.84	0.55	456.15	10,612	8.88	11.54	0.034	-	-		
A2-1	0.75	0.44	321.15	17,970	13.28	-	-	-	-		
A2-2	0.92	0.67	331.15	37,802	19.03	-	-	-	-		
A2-3 (BioAtlantis)	0.60	0.28	Ambient	2,674	2.77	-	-	1,680 / (38,152, 1 hr per day)	1.25 / (28.3,1 hr per day)		
A3-3	0.78	0.25	289.2	2,822	16.90	-	-	-	-		

Table 8-8 North Cork Creameries, Kanturk, Co. Cork. Current Stack Emission Details for NO_2, SO_2, CO, odour and PM_{10} / $PM_{2.5}$.

Stack Reference	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temperature (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_2 Concentration (mg/Nm^3)	NO_2 Mass Emission (g/s)	SO_2 Concentration (mg/Nm^3)	SO_2 Mass Emission (g/s)	PM_{10} / $PM_{2.5}$ Concentration (mg/Nm^3)	PM_{10} / $PM_{2.5}$ Mass Emission (g/s)
A1-2	0.7	0.38	419.15	24,478	45.51	250	1.70				
A1-3	0.84	0.55	456.15	10,612	8.88	200	0.44	39.30	0.09	50.00	0.11
A2-1	0.8	0.4	321.2	17,970	13.28	-	-	-	-	37.1	0.185
A2-2	0.9	0.7	331.2	37,802	19.03	-	-	-	-	87.2	0.916
A2-3 (BioAtlantis)	0.6	0.3	Ambient	2,674	2.77	-	-	-	-	-	-
A3-3	0.8	0.3	289.2	2,822	16.90	-		-	-	0.8	0.001
Stack Reference	**Exit Diameter (m)**	**Cross-Sectional Area (m2)**	**Temperature (K)**	**Max Volume Flow (Nm^3/hr)**	**Exit Velocity (m/sec actual)**	**CO Concentration (mg/Nm^3)**	**CO Mass Emission (g/s)**	**Odour Concentration (OU_E/s)**	**Odour Mass Emission (OU_E/s)**		
A1-2	0.70	0.38	419.15	24,478	45.51	40	0.272	-	-		
A1-3	0.84	0.55	456.15	10,612	8.88	100	0.221	-	-		
A2-1	0.75	0.44	321.15	17,970	13.28	-	-	-	-		
A2-2	0.92	0.67	331.15	37,802	19.03	-	-	-	-		
A2-3 (BioAtlantis)	0.60	0.28	Ambient	2,674	2.77	-	-	1,680 / 38,152 (1 hr per day)	1.25 / 28.3 (1 hr per day)		
A3-3	0.78	0.25	289.2	2,822	16.90	-	-	-	-		

Table 8-9 North Cork Creameries, Kanturk, Co. Cork. Proposed Stack Emission Details for NO_2, SO_2, CO, odour and PM_{10} / $PM_{2.5}$.

8.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

The potential impact of the operational phase is a breach of the ambient air quality standards if no adaptions are made to the current scenario. However, as outlined in Section 8.6, A2-1 has been removed, A2-2 is proposed to be upgraded to run on LPG and A2-3 will become a backup boiler only running 32 hours a year. The stack height of A2-2 will also be increased to ensure no breach of the air quality standards.

8.6 REMEDIAL AND MITIGATION MEASURES

A2-1 has been removed, A2-2 is proposed to be upgraded to run on LPG and A2-3 will become a backup boiler only running 32 hours a year. The stack height of A2-2 will also be increased to 22 m. This height was selected to aid dispersion of the plume and to ensure no breach of the air quality standards.

The changes to the boilers and increase in stack height ensure compliance with the ambient air quality standards and thus no additional mitigation measures are required.

8.7 PREDICTED IMPACTS OF THE DEVELOPMENT

8.7.1 Contributions Under Current Operations – Do Nothing

Ambient Ground Level Concentrations (GLCs) of NO_2, CO, odour, PM_{10} / $PM_{2.5}$ and SO_2 have been predicted below in Tables 8.10 – 8.15 for current conditions.

NO_2 Emissions

The NO_2 modelling results are detailed in Table 8-10. The results indicate that the ambient ground level concentrations are significantly above the relevant air quality standards for NO_2 for the Do-Nothing scenario. Emissions from the three boilers lead to an ambient NO_2 concentration (including background) which is 282% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) (see Figure 8.5) and 147% of the annual limit value at the worst-case receptor.

Pollutant/ Meteorological year	Background (µg/m^3)	Averaging Period	NO_2 Process Contribution (µg/m^3)	NO_2 Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3) *Note 1*
NO_2 / 2008	22	99.8th%ile of 1-hr means	541.7	563.7	200
	11	Annual Mean	42.0	53.0	40
NO_2 / 2009	22	99.8th%ile of 1-hr means	520.7	542.7	200
	11	Annual Mean	39.9	50.9	40
NO_2 / 2010	22	99.8th%ile of 1-hr means	433.3	455.3	200
	11	Annual Mean	36.0	47.0	40
NO_2 / 2011	22	99.8th%ile of 1-hr means	473.5	495.5	200
	11	Annual Mean	44.2	55.2	40
NO_2 / 2012	22	99.8th%ile of 1-hr means	416.1	438.1	200
	11	Annual Mean	47.8	58.8	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-10 Dispersion Model Results Do-Nothing Scenario – NO_2

PM_{10} / $PM_{2.5}$ Emissions

The PM_{10} / $PM_{2.5}$ modelling results are detailed in Table 8-11 and Table 8-12. The results indicate that the ambient ground level concentration is significantly above the relevant air quality standard for PM_{10} / $PM_{2.5}$. Emissions from the facility lead to an ambient PM_{10} concentration (including background) which is at most up to 263% of the ambient 24-hour limit value at the worst-case receptor. In relation to the annual mean concentration, ambient PM_{10} / $PM_{2.5}$ concentration (including background) are at most 245% of the annual mean limit values at the worst-case receptor (Figure 8.6).

Pollutant/ Meteorological year	Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3) *Note 1*
PM_{10} / 2008	N/A	24 Hour 90.4th%ile	111.7	125.2	50
	13.4	Annual Mean	48.9	62.3	40
PM_{10} / 2009	N/A	24 Hour 90.4th%ile	108.3	121.7	50
	13.4	Annual Mean	47.0	60.4	40
PM_{10} / 2010	N/A	24 Hour 90.4th%ile	104.5	117.9	50
	13.4	Annual Mean	40.4	53.8	40
PM_{10} / 2011	N/A	24 Hour 90.4th%ile	118.0	131.4	50
	13.4	Annual Mean	53.3	66.7	40
PM_{10} / 2012	N/A	24 Hour 90.4th%ile	114.8	128.2	50
	13.4	Annual Mean	49.7	63.1	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Note 2 Short-term Environmental Concentrations calculated according to UK DEFRA guidance(23) based on the maximum background 24-hr mean (as a 90th%ile) of 24.4 µg/m^3

Table 8-11 Dispersion Model Results Do-Nothing Scenario – PM_{10}

Pollutant/ Meteorological year	Annual Mean Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3) *Note 1*
$PM_{2.5}$ / 2008	8	Annual Mean	48.9	56.9	25
$PM_{2.5}$ / 2009	8	Annual Mean	47.0	55.1	25
$PM_{2.5}$ / 2010	8	Annual Mean	40.4	48.4	25
$PM_{2.5}$ / 2011	8	Annual Mean	53.3	61.3	25
$PM_{2.5}$ / 2012	8	Annual Mean	49.7	57.7	25

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-12 Dispersion Model Results Do-Nothing Scenario – $PM_{2.5}$

SO_2 Emissions

The SO_2 modelling results are detailed in Table 8-13 and Figure 8.7. The results indicate that the ambient ground level concentrations are significantly above the relevant air quality standards for SO_2. Emissions from the three boilers lead to an ambient SO_2 concentration (including background) which is 1157% of the maximum ambient 1-hour limit value (measured as a 99.7th%ile) and 678% of the 24 hour limit value (measured as a 99.2nd%ile) at the worst-case receptor.

Pollutant/ Meteorological year	Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3)
SO_2 / 2008	10	1-Hour 99.7th%ile	4,039	4,049	350
	6.6	24 Hour 99.2nd%ile	790	796	125
SO_2 / 2009	10	1-Hour 99.7th%ile	3,902	3,912	350
	6.6	24 Hour 99.2nd%ile	841	848	125
SO_2 / 2010	10	1-Hour 99.7th%ile	3,373	3,383	350
	6.6	24 Hour 99.2nd%ile	702	709	125
SO_2 / 2011	10	1-Hour 99.7th%ile	3,663	3,673	350
	6.6	24 Hour 99.2nd%ile	707	714	125
SO_2 / 2012	10	1-Hour 99.7th%ile	3,222	3,232	350
	6.6	24 Hour 99.2nd%ile	680	686	125

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-13 *Dispersion Model Results Do-Nothing Scenario – SO_2*

CO Emissions

The CO modelling results are detailed in Table 8-14 below. The results indicate that the ambient ground level concentrations are just below the relevant air quality standards for CO. Emissions from the three gas boilers lead to an ambient CO concentration (including background) which is 24% of the maximum 8-hour average at the worst-case receptor.

Pollutant/ Meteorological year	Background (mg/m^3)	Averaging Period	Process Contribution (mg/m^3)	Predicted Environmental Concentration (PEC) (mg/Nm^3)	Standard (mg/Nm^3)
CO / 2008	2.4	8 hour maximum	0.01	2.41	10
CO / 2009	2.4	8 hour maximum	0.01	2.41	10
CO / 2010	2.4	8 hour maximum	0.01	2.41	10
CO / 2011	2.4	8 hour maximum	0.01	2.41	10
CO / 2012	2.4	8 hour maximum	0.01	2.41	10

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-14 Dispersion Model Results Do-Nothing Scenario – CO

Odour Emissions

The odour emission point is located at BioAtlantis. Details of the 98th%ile of 1-hour mean odour concentrations at the worst case off site location are given in Table 8-15. The worst case scenario occurs in 2008 where the maximum off-site concentration is 2% of the 98th%ile of one-hour guideline value at the boundary of the site.

Pollutant/ Meteorological year	Averaging Period	Predicted Odour Concentration (OU_E/m^3)	Guideline (OU_E/m^3) EPA AG4 (2010)
Odour / 2008	Maximum 1-Hour (as a 98^{th}%ile)	0.029	1.5 (UK Guidance)
Odour / 2009	Maximum 1-Hour (as a 98^{th}%ile)	0.025	1.5 (UK Guidance)
Odour / 2010	Maximum 1-Hour (as a 98^{th}%ile)	0.017	1.5 (UK Guidance)
Odour / 2011	Maximum 1-Hour (as a 98^{th}%ile)	0.027	1.5 (UK Guidance)
Odour / 2012	Maximum 1-Hour (as a 98^{th}%ile)	0.023	1.5 (UK Guidance)

Table 8-15 Predicted Odour Concentration At Worst-Case Offsite Receptor(OU_E/m^3)

8.7.2 Process Contributions Using Single LPG Boiler - Do-Something

Ambient Ground Level Concentrations (GLCs) of NO_2, CO, odour, PM_{10} / $PM_{2.5}$ and SO_2 have been predicted below in Table 8-16 – 8-21 for a single LPG boiler. The change of fuel is designed to reduce ambient concentrations to below the limit values for NO_2, PM_{10}/$PM_{2.5}$ and SO_2.

NO_2 Emissions

The NO_2 modelling results are detailed in Table 8-16 and Figure 8.8. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2 for the single LPG boiler scenario. Emissions from the boiler lead to an ambient NO_2 concentration (including background) which is 76% of the maximum ambient 1-hour limit value (measured as a 99.8^{th}%ile) and 56% of the annual limit value at the worst-case receptor.

Pollutant/ Meteorological year	Annual Mean Background (µg/m^3)	Averaging Period	NO_2 Process Contribution (µg/m^3)	NO_2 Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3)
NO_2 / 2008	11	Annual Mean	112.4	134.4	40
	22	99.8th%ile of 1-hr means	11.5	22.5	200
NO_2 / 2009	11	Annual Mean	110.5	132.5	40
	22	99.8th%ile of 1-hr means	9.3	20.3	200
NO_2 / 2010	11	Annual Mean	88.5	110.5	40
	22	99.8th%ile of 1-hr means	5.5	16.5	200
NO_2 / 2011	11	Annual Mean	130.2	152.2	40
	22	99.8th%ile of 1-hr means	11.1	22.1	200
NO_2 / 2012	11	Annual Mean	103.1	125.1	40
	22	99.8th%ile of 1-hr means	7.2	18.2	200

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-16 Dispersion Model Results Using Single LPG Boiler – NO_2

PM_{10} / $PM_{2.5}$ Emissions

The PM_{10} / $PM_{2.5}$ modelling results for the single LPG boiler conditions are detailed in Table 8-17 and Table 8-18 below. The results indicate that the ambient ground level concentration is below the relevant air quality standard for PM_{10} / $PM_{2.5}$ in the single LPG boiler scenario. Emissions from the facility lead to an ambient PM_{10} concentration (including background) which is at most up to 72% of the ambient 24-hour limit value at the worst-case receptor. In relation to the annual mean concentration, ambient PM_{10} / $PM_{2.5}$ concentration (including background) are at most 78% of the annual mean limit values at the worst-case receptor (Figure 8.9).

Pollutant/ Meteorological year	Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3)
PM_{10} / 2008	N/A	24 Hour 90.4th%ile	21.0	34.4	50
	13.4	Annual Mean	9.0	22.4	40
PM_{10} / 2009	N/A	24 Hour 90.4th%ile	22.1	35.5	50
	13.4	Annual Mean	11.1	24.5	40
PM_{10} / 2010	N/A	24 Hour 90.4th%ile	21.3	34.7	50
	13.4	Annual Mean	11.1	24.5	40
PM_{10} / 2011	N/A	24 Hour 90.4th%ile	22.8	36.2	50
	13.4	Annual Mean	11.4	24.8	40
PM_{10} / 2012	N/A	24 Hour 90.4th%ile	21.9	35.3	50
	13.4	Annual Mean	10.2	23.6	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Note 2 Short-term Environmental Concentrations calculated according to UK DEFRA guidance[23] based on the maximum background 24-hr mean (as a 90th%ile) of 24.4 µg/m^3

Table 8-17 Dispersion Model Results Using Single LPG Boiler – PM_{10}

Pollutant/ Meteorological year	Annual Mean Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Environmental Concentration (PEC) (µg/Nm^3)	Standard (µg/Nm^3)
$PM_{2.5}$ / 2008	8.0	Annual Mean	9.0	17.0	25
$PM_{2.5}$ / 2009	8.0	Annual Mean	11.1	19.1	25
$PM_{2.5}$ / 2010	8.0	Annual Mean	11.1	19.1	25
$PM_{2.5}$ / 2011	8.0	Annual Mean	11.4	19.4	25
$PM_{2.5}$ / 2012	8.0	Annual Mean	10.2	18.2	25

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-18 Dispersion Model Results Single LPG Boiler – $PM_{2.5}$

SO_2 Emissions

The SO_2 modelling results using LPG fuel are detailed in Table **8-19** and Figure 8.10. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for SO_2 for the single LPG boiler scenario. Emissions from the boiler lead to an ambient SO_2 concentration (including background) which is 3% of the maximum ambient 1-hour limit value (measured as a 99.7th%ile) and 12% of the 24 hour limit value (measured as a 99.2nd%ile) at the worst-case receptor.

Pollutant/ Meteorological year	Background ($\mu g/m^3$)	Averaging Period	Process Contribution ($\mu g/m^3$)	Predicted Environmental Concentration (PEC) ($\mu g/Nm^3$)	Standard ($\mu g/Nm^3$)
SO_2 / 2008	10	1-Hour 99.7th%ile	0.81	10.17	350
	6.6	24 Hour 99.2nd%ile	4.21	10.21	125
SO_2 / 2009	10	1-Hour 99.7th%ile	0.46	10.21	350
	6.6	24 Hour 99.2nd%ile	5.06	11.06	125
SO_2 / 2010	10	1-Hour 99.7th%ile	0.77	10.30	350
	6.6	24 Hour 99.2nd%ile	8.51	14.51	125
SO_2 / 2011	10	1-Hour 99.7th%ile	0.37	10.25	350
	6.6	24 Hour 99.2nd%ile	5.89	11.89	125
SO_2 / 2012	10	1-Hour 99.7th%ile	0.63	10.21	350
	6.6	24 Hour 99.2nd%ile	3.90	9.90	125

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-19 Dispersion Model Results Using Single LPG Boiler – SO_2

CO Emissions

The CO modelling results are detailed in Table 8-20 below. The results indicate that the ambient ground level concentrations are just below the relevant air quality standards for CO. Emissions from the boiler lead to an ambient CO concentration (including background) which is 24% of the maximum 8-hour average at the worst-case receptor.

Pollutant/ Meteorological year	Background (mg/m^3)	Averaging Period	Process Contribution ($\mu g/m^3$)	Predicted Environmental Concentration (PEC) m/Nm^3)	Standard (mg/Nm^3)
CO / 2008	2.4	8 hour maximum	0.008	2.408	10
CO / 2009	2.4	8 hour maximum	0.006	2.406	10
CO / 2010	2.4	8 hour maximum	0.006	2.406	10
CO / 2011	2.4	8 hour maximum	0.005	2.405	10
CO / 2012	2.4	8 hour maximum	0.005	2.405	10

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC)

Table 8-20 Dispersion Model Results Using Single LPG Boiler – CO

Odour Emissions

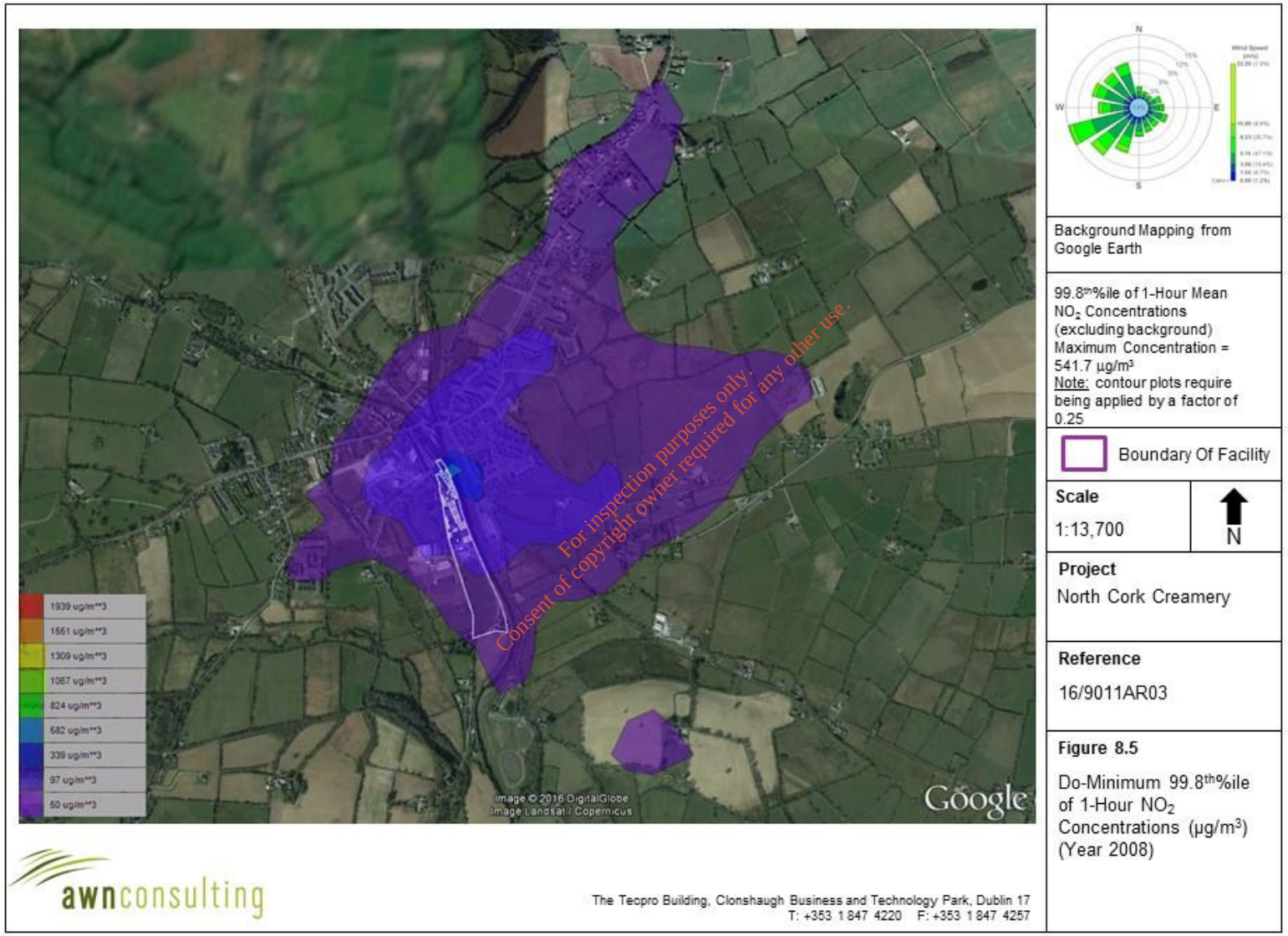
Odour concentrations are not predicted to change due to the installation of a single LPG boiler system. Details of the 98th%ile of 1-hour mean odour concentrations at the worst case off site location are given in

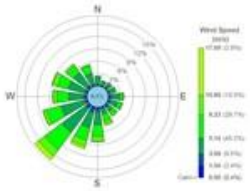
Pollutant/ Meteorological year	Averaging Period	Predicted Odour Concentration (OUE/m3)	Guideline (OUE/m3) EPA AG4 (2010)
Odour / 2008	Maximum 1-Hour (as a 98th%ile)	0.029	1.5 (UK Guidance)
Odour / 2009	Maximum 1-Hour (as a 98th%ile)	0.025	1.5 (UK Guidance)
Odour / 2010	Maximum 1-Hour (as a 98th%ile)	0.017	1.5 (UK Guidance)
Odour / 2011	Maximum 1-Hour (as a 98th%ile)	0.027	1.5 (UK Guidance)
Odour / 2012	Maximum 1-Hour (as a 98th%ile)	0.023	1.5 (UK Guidance)

Table 8-21. The worst case scenario has a maximum off-site concentration of 2% of the 98th%ile of one-hour guideline value at the boundary of the site.

Pollutant/ Meteorological year	Averaging Period	Predicted Odour Concentration (OU_E/m^3)	Guideline (OU_E/m^3) EPA AG4 (2010)
Odour / 2008	Maximum 1-Hour (as a 98th%ile)	0.029	1.5 (UK Guidance)
Odour / 2009	Maximum 1-Hour (as a 98th%ile)	0.025	1.5 (UK Guidance)
Odour / 2010	Maximum 1-Hour (as a 98th%ile)	0.017	1.5 (UK Guidance)
Odour / 2011	Maximum 1-Hour (as a 98th%ile)	0.027	1.5 (UK Guidance)
Odour / 2012	Maximum 1-Hour (as a 98th%ile)	0.023	1.5 (UK Guidance)

Table 8-21 Predicted Odour Concentration At Worst-Case Offsite Receptor (OU_E/m^3)





Background Mapping from Google Earth

Annual Mean PM_{10} Concentrations (excluding background)
Maximum Concentration = 53.3 µg/m³

Boundary Of Facility

Scale
1:7,000

N

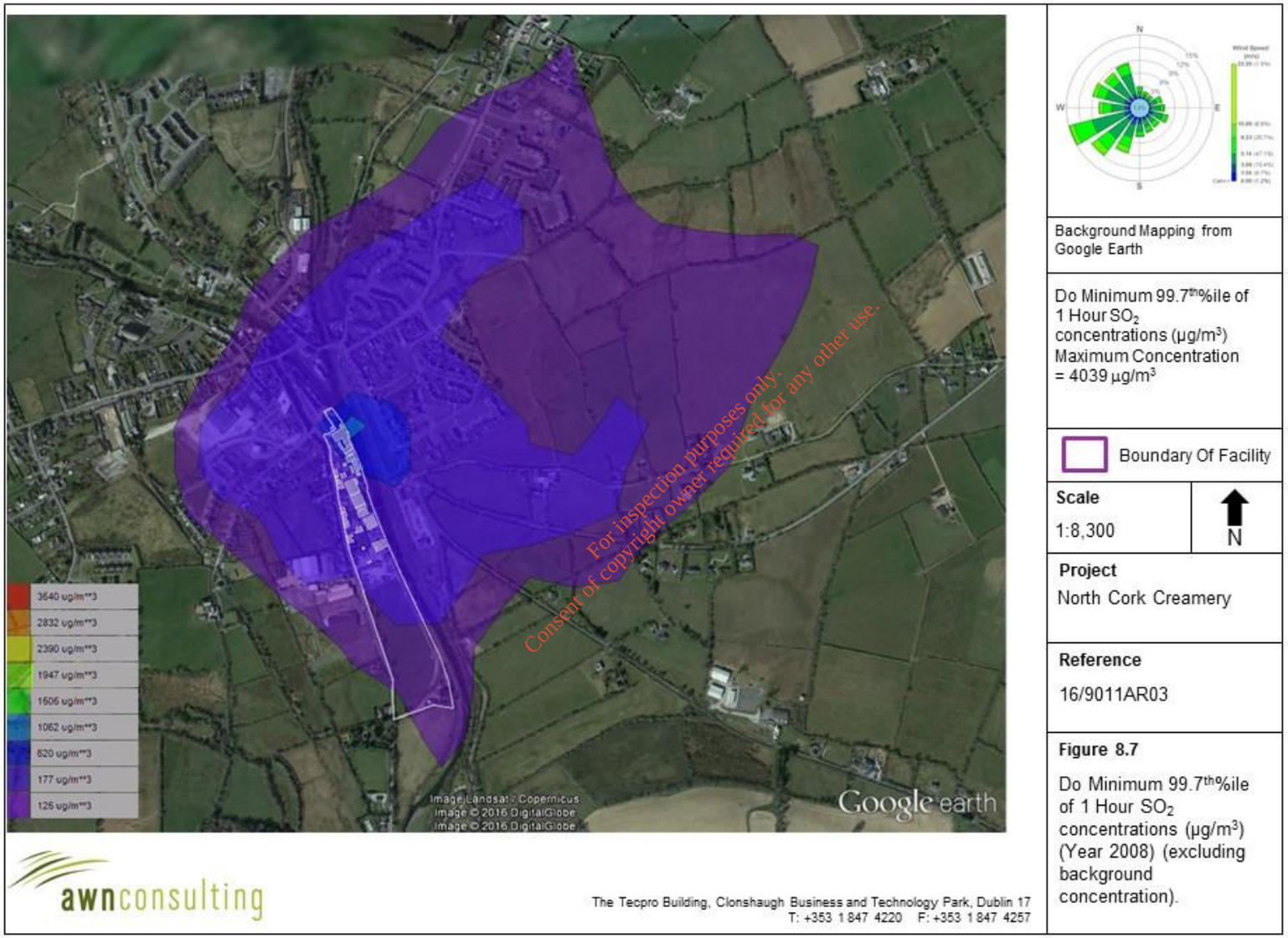
Project
North Cork Creamery

Reference
16/9011AR03

Figure 8.6
Do-Nothing Annual Mean PM_{10} Concentrations (µg/m³) (Year 2011)

awnconsulting

The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



awnconsulting

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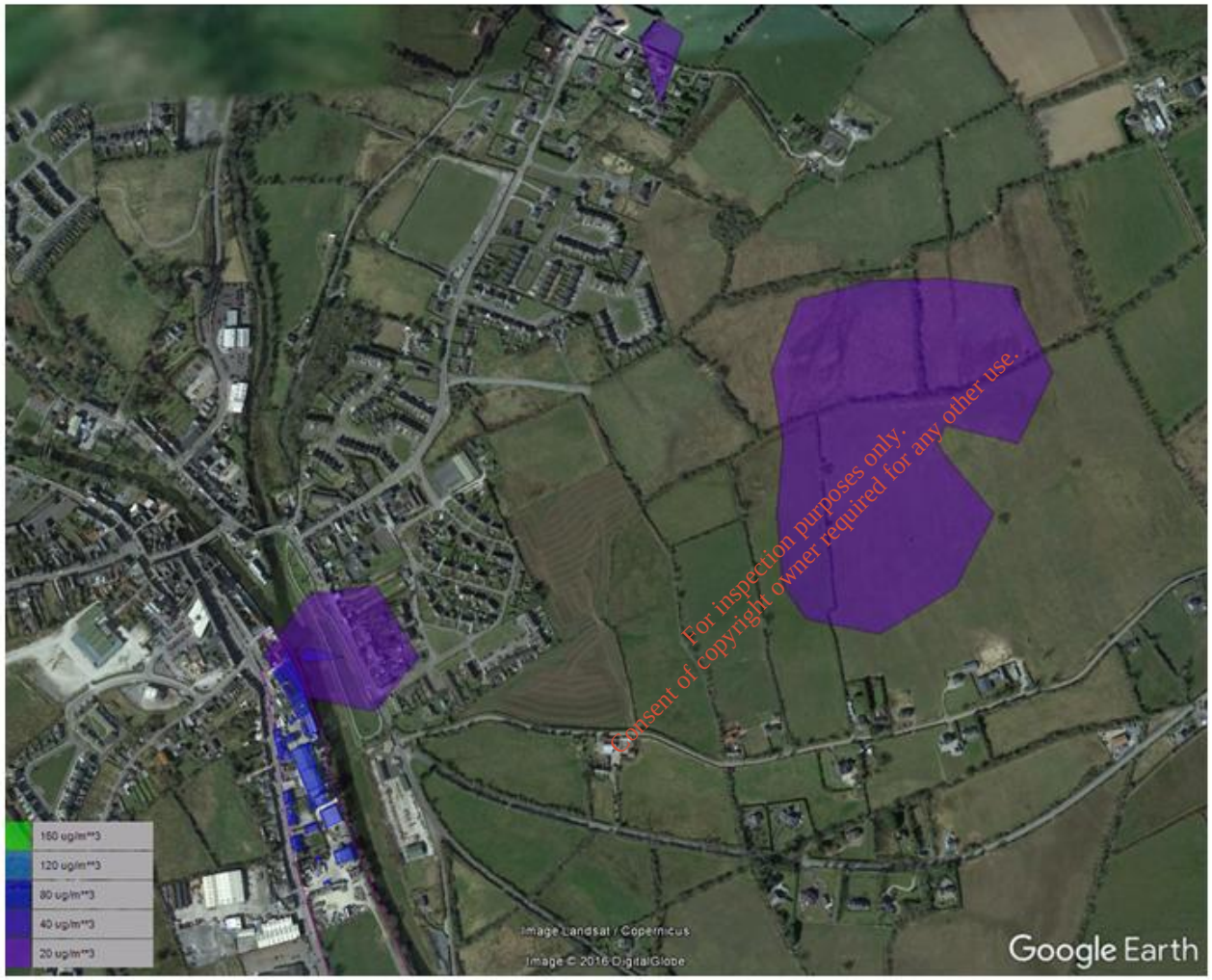
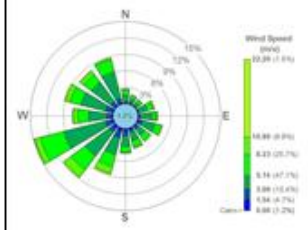
T: +353 1 847 4220 F: +353 1 847 4257





Background Mapping from Google Earth

99.8th%ile of 1-Hour Mean NO_2 Concentrations (excluding background) Maximum Concentration = 130 µg/m³
Note: contour plots require being applied by a factor of 0.25

Boundary Of Facility

Scale
1:5,800

N

Project
North Cork Creamery

Reference
16/9011AR03

Figure 8.8
99.8th%ile of 1-Hour NO_2 Concentrations for LPG Scenario (µg/m³) (Year 2008)

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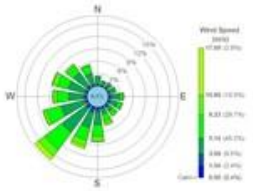

Background Mapping from Google Earth

LPG Scenario Annual Mean PM_{10} Concentrations (excluding background) Maximum Concentration = 12.1 µg/m³

Boundary Of Facility

Scale
1:5,350

N

Project
North Cork Creamery

Reference
16/9011AR03

Figure 8.9
Annual Mean PM_{10} Concentrations for LPG Scenario (µg/m³) (Year 2011)

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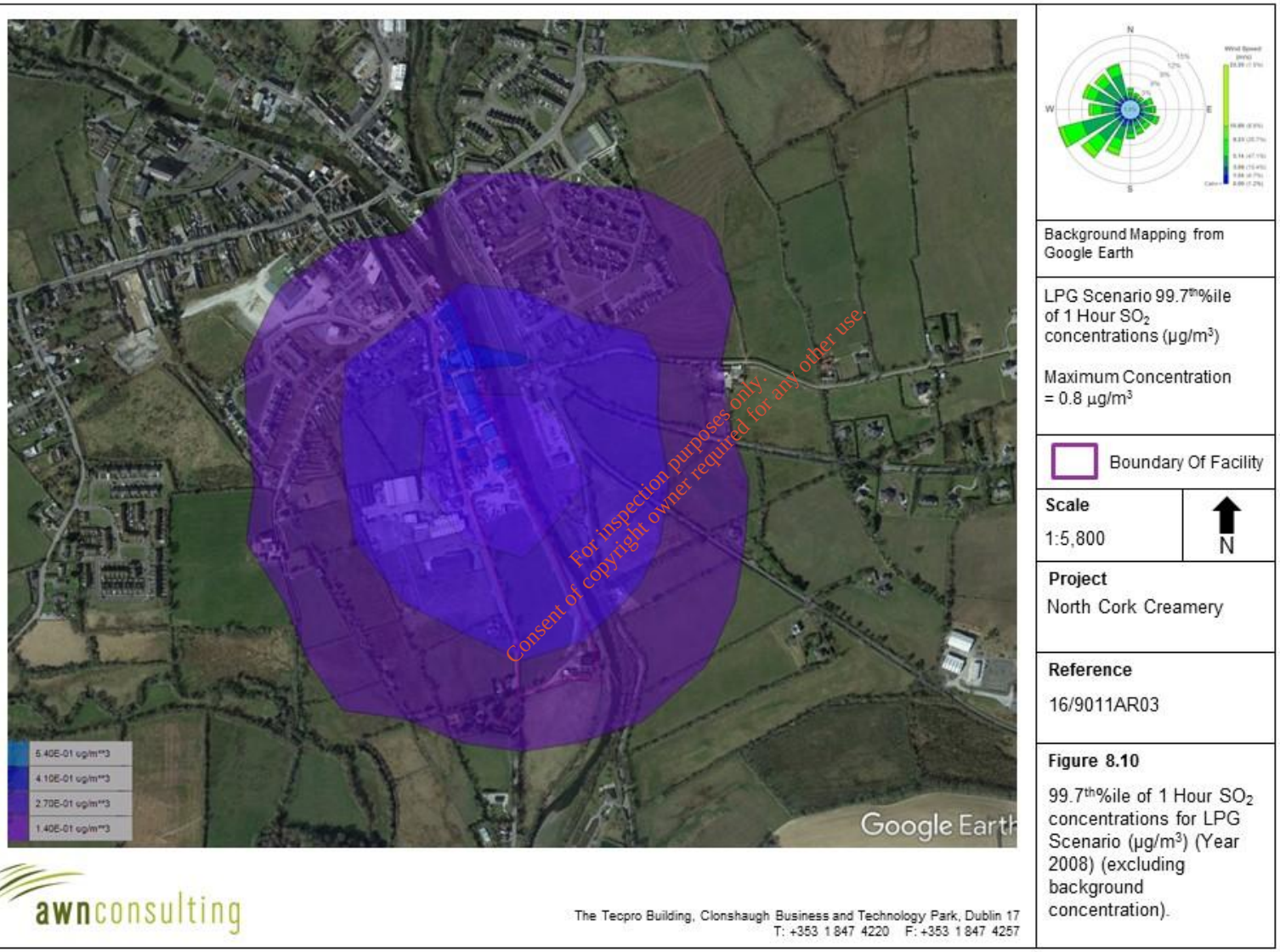

8.7.3 Assessment Summary

Modelling of the current operational scenario predicts that ambient NO_2, SO_2 and $PM_{10}/PM_{2.5}$ concentrations are significantly above their respective limit values. For this reason, a new LPG fuel option was reviewed to assess if this will reduce worst case ambient concentrations to below the pollutants respective limit values.

It is assumed that the main boiler (A1-2) will run continuously on LPG fuel. Boiler A1-3 will remain running on HFO but will become a backup boiler running for 2 hours a day once a week for 4 months. Boiler A1-1 will be removed.

For CO, both the current operational and the single LPG boiler scenario modelled will lead to ambient CO concentrations (including background) which are in compliance with the relevant limit value, reaching at most 24% of the 8 hour maximum limit value at the worst-case receptor.

With regard to NO_2, the single LPG boiler scenario modelled will lead to ambient NO_2 concentrations (including background) which are in compliance with the relevant limit values, reaching at most 76% of the 1-hour limit value (measured as a 99.8th%ile) and 56% of the annual limit value at the worst-case receptor.

With regard to PM_{10} / $PM_{2.5}$, emissions from the facility will lead to ambient PM_{10} / $PM_{2.5}$ levels (including background) which are in compliance with the relevant limit values, with levels reaching at most 78% of the relevant annual mean limit values at the worst-case off site location. The maximum 24-hour mean values (measured as a 90th%ile) is up to 72% of the limit value for PM_{10}.

For SO_2, the single LPG boiler scenario modelled will lead to ambient SO_2 concentrations (including background) which are in compliance with the relevant limit values, reaching at most 3% of the 1-hour limit value (measured as a 99.7th%ile) and 12% of the 24-hour mean limit values (measured as a 99.2nd%ile) at the worst-case receptor.

For odour, there will be no change with the single LPG boiler scenario. The worst case scenario has a maximum off-site concentrations is 2% of the 98th%ile of one-hour guideline value at the boundary of the site.

In summary, emissions of NO_2, SO_2 and $PM_{10}/PM_{2.5}$ under current operations of the facility are significantly above the ambient air quality standards. However, changing to a single boiler system using LPG fuel in A1-2 will result in compliance with the relevant air quality standards at the worst case off-site receptor. Ambient concentrations for odour and CO achieve their relevant air quality standards in both scenarios.

8.8 CUMULATIVE IMPACTS OF THE DEVELOPMENT

There is no predicted cumulative impact for the development.

8.9 REFERENCES

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APPENDIX 8.1

Description of the AERMOD Model

The AERMOD dispersion model has been developed in part by the U.S. Environmental Protection Agency (USEPA)[1,3]. The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD with PRIME, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets[6].

Due to the proximity to surrounding buildings, the PRIME (Plume Rise Model Enhancements) building downwash algorithm has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered. The PRIME algorithm takes into account the position of the stack relative to the building in calculating building downwash. In the absence of the building, the plume from the stack will rise due to momentum and/or buoyancy forces. Wind streamlines act on the plume leads to the bending over of the plume as it disperses. However, due to the presence of the building, wind streamlines are disrupted leading to a lowering of the plume centreline.

When there are multiple buildings, the building tier leading to the largest cavity height is used to determine building downwash. The cavity height calculation is an empirical formula based on building height, the length scale (which is a factor of building height & width) and the cavity length (which is based on building width, length and height). As the direction of the wind will lead to the identification of differing dominant tiers, calculations are carried out in intervals of 10 degrees.

In PRIME, the nature of the wind streamline disruption as it passes over the dominant building tier is a function of the exact dimensions of the building and the angle at which the wind approaches the building. Once the streamline encounters the zone of influence of the building, two forces act on the plume. Firstly, the disruption caused by the building leads to increased turbulence and enhances horizontal and vertical dispersion. Secondly, the streamline descends in the lee of the building due to the reduced pressure and drags the plume (or part of) nearer to the ground, leading to higher ground level concentrations. The model calculates the descent of the plume as a function of the building shape and, using a numerical plume rise model, calculates the change in the plume centreline location with distance downwind.

The immediate zone in the lee of the building is termed the cavity or near wake and is characterised by high intensity turbulence and an area of uniform low pressure. Plume mass captured by the cavity region is re-emitted to the far wake as a ground-level volume source. The volume source is located at the base of the lee wall of the building, but is only evaluated near the end of the near wake and beyond. In this region, the disruption caused by the building downwash gradually fades with distance to ambient values downwind of the building.

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3[1,3]. ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height[1,3]. The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also has the capability of modelling both unstable (convective) conditions and stable (inversion) conditions. The stability of the atmosphere is defined by the sign of the sensible heat flux. Where the sensible heat flux is positive, the atmosphere is unstable whereas when the sensible heat flux is negative the atmosphere is defined as stable. The sensible heat flux is dependent on the net radiation and the available surface moisture (Bowen Ratio). Under stable (inversion) conditions, AERMOD has specific algorithms to account for plume rise under stable conditions, mechanical mixing heights under stable conditions and vertical and lateral dispersion in the stable boundary layer.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

APPENDIX 8.2

Meteorological Data - AERMET PRO

AERMOD incorporates a meteorological pre-processor AERMET PRO[18]. AERMET PRO allows AERMOD to account for changes in the plume behaviour with height. AERMET PRO calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET PRO meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET PRO for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET PRO calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations[5] and using the detailed methodology outlined by the Alaska Department of Environmental Conservation[20].

Surface roughness

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on an upwind area-weighted average of the land use within the sector, by using the eight land use categories outlined by the USEPA. The inverse-distance weighted surface roughness length derived from the land use classification within a radius of 1km from Cork Airport Meteorological Station is shown in Table A1.

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
350-50	60% Urban, 40% Grassland	0.213	0.305	0.093	0.093
50-350	100% Grassland	0.050	0.100	0.010	0.010

(1) Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983)[23]. Thus for the current location autumn more accurately defines "winter" conditions in Ireland.

Table A1 Surface Roughness based on an inverse distance weighted average of the land use within a 1km radius of Cork Airport Meteorological Station.

Albedo

Noon-time albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. A 10km x 10km square area is drawn around the meteorological station to determine the albedo based on a simple average for the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Cork Airport Meteorological Station is shown in Table A2.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
19% Urban, 81% Grassland	0.17	0.18	0.20	0.20

(1) For the current location autumn more accurately defines "winter" conditions in Ireland.

Table A2 Albedo based on a simple average of the land use within a 10km × 10km grid centred on Cork Airport Meteorological Station.

Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. A 10km x 10km square area is drawn around the meteorological station to determine the Bowen Ratio based on geometric mean of the land use types within the area independent of both distance from the station and the near-field sector. The classification within 10km from Cork Airport Meteorological Station is shown in Table A3.

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
19% Urban, 81% Grassland	0.47	0.95	1.14	1.14

(1) For the current location autumn more accurately defines "winter" conditions in Ireland.

Table A3 Bowen Ratio based on a geometric mean of the land use within a 10km × 10km grid centred on Cork Airport Meteorological Station.

APPENDIX 8.3

Detailed Meteorological Data – Cork Airport 2008 - 2012

Cork Airport 2008

Dir \ Spd	<= 1.54	<= 3.09	<= 5.14	<= 8.23	<= 10.80	> 10.80	Total
0.0	12	20	111	77	19	0	239
22.5	10	21	60	43	22	0	156
45.0	8	14	53	40	20	4	139
67.5	6	22	136	92	24	1	281
90.0	13	26	190	58	19	10	316
112.5	27	56	209	83	33	4	412
135.0	17	47	124	95	28	0	311
157.5	25	39	149	91	27	5	336
180.0	45	73	173	87	17	4	399
202.5	53	112	272	205	108	20	770
225.0	44	78	478	280	140	17	1,037
247.5	32	102	680	390	88	12	1,304
270.0	32	70	284	178	71	12	647
292.5	42	93	400	182	67	25	809
315.0	23	72	383	158	63	16	715
337.5	27	67	439	202	27	4	766
Total	416	912	4,141	2,261	773	134	8,637
Calms							105
Missing							42
Total							8,784

Cork Airport 2009

Dir \ Spd	<= 1.54	<= 3.09	<= 5.14	<= 8.23	<= 10.80	> 10.80	Total
0.0	9	17	114	82	18	1	241
22.5	6	10	85	46	4	0	151
45.0	3	19	72	37	24	5	160
67.5	4	15	111	51	26	17	224
90.0	16	26	181	115	25	2	365
112.5	7	27	197	137	2	0	370
135.0	6	30	153	112	24	13	338
157.5	12	47	224	136	58	16	493
180.0	23	106	318	194	67	9	717
202.5	45	99	378	352	104	55	1,033
225.0	34	85	628	416	93	29	1,285
247.5	26	56	473	224	45	5	829
270.0	25	63	290	231	55	7	671
292.5	18	78	326	169	85	8	684
315.0	12	71	350	183	66	7	689
337.5	9	27	202	141	54	13	446
Total	255	776	4,102	2,626	750	187	8,696
Calms							57
Missing							7
Total							8,760

Cork Airport 2010

Dir \ Spd	<= 1.54	<= 3.09	<= 5.14	<= 8.23	<= 10.80	> 10.80	Total
0.0	3	35	310	174	13	0	535
22.5	9	26	183	88	9	0	315
45.0	10	25	161	116	5	0	317
67.5	10	22	110	52	5	0	199
90.0	10	44	190	99	27	6	376
112.5	6	32	176	106	36	13	369
135.0	4	27	153	144	45	16	389
157.5	9	26	152	103	33	10	333
180.0	22	74	249	133	59	10	547
202.5	23	91	325	214	50	6	709
225.0	15	70	479	211	68	5	848
247.5	14	55	365	142	34	7	617
270.0	29	76	235	103	13	3	459
292.5	17	70	450	166	35	12	750
315.0	8	71	671	269	54	9	1,082
337.5	6	31	441	382	25	6	891
Total	195	775	4,650	2,502	511	103	8,736
Calms							24
Missing							0
Total							8,760

Cork Airport 2011

Dir \ Spd	<= 1.54	<= 3.09	<= 5.14	<= 8.23	<= 10.80	> 10.80	Total
0.0	3	35	146	27	2	0	213
22.5	9	18	82	16	0	0	125
45.0	6	38	77	29	5	0	155
67.5	6	33	98	35	8	0	180
90.0	17	64	164	70	17	0	332
112.5	11	43	165	82	22	1	324
135.0	12	49	116	78	39	7	301
157.5	14	35	118	152	58	34	411
180.0	25	79	269	244	104	10	731
202.5	31	90	337	269	129	55	911
225.0	20	73	627	454	168	99	1,441
247.5	16	42	519	319	69	14	979
270.0	13	71	304	256	76	15	735
292.5	11	55	357	234	107	10	774
315.0	9	65	341	171	49	5	640
337.5	7	38	241	168	22	1	477
Total	210	828	3,961	2,604	875	251	8,729
Calms							31
Missing							0
Total							8,760

Cork Airport 2012

Dir \ Spd	<= 1.54	<= 3.09	<= 5.14	<= 8.23	<= 10.80	> 10.80	Total
0.0	8	26	134	117	32	10	327
22.5	3	15	91	37	18	7	171
45.0	6	18	85	75	16	2	202
67.5	8	19	101	40	14	1	183
90.0	7	30	184	108	26	5	360
112.5	11	40	183	118	25	9	386
135.0	10	30	177	123	57	13	410
157.5	21	29	172	89	28	1	340
180.0	21	83	345	159	44	13	665
202.5	22	69	330	230	89	26	766
225.0	13	78	599	354	71	17	1,132
247.5	15	48	521	298	34	2	918
270.0	33	59	388	206	51	9	746
292.5	24	52	390	207	72	16	761
315.0	16	59	402	233	63	7	780
337.5	8	18	205	251	66	15	563
Total	226	673	4,307	2,645	706	153	8,710
Calms							66
Missing							8
Total							8,784

9.0 NOISE AND VIBRATION

9.1 INTRODUCTION

This section of the Environmental Impact Statement assesses the noise from the existing North Cork Co-operative Creameries Ltd. (NCCCL) site to the local receiving environment. This noise chapter has been prepared by CLV Consulting Limited and the noise impact from the current activities have only been assessed as to date there are no extra buildings or processes planned.

9.2 METHODOLOGY

9.2.1 Noise Assessment Methodology

This methodology used in this assessment is as follows;

- Select the appropriate noise criteria for the site;
- Carry out an environmental noise survey in the vicinity of the site;
- Review the noise survey results from the environmental survey;
- Assess and comment on the existing noise levels from the site against the selected noise criteria.
- Recommend mitigation measures to bring the noise emission from the site in line with the adopted EPA criteria.

9.3 ASSESSMENT CRITERIA

This assessment only deals with the existing noise emissions from the site and road traffic noise as there is no construction or future development currently planned to take place.

9.3.1 Existing Operational Noise

This EIS is being completed to support an application for an Industrial Emissions Licence for the creamery. Following on from a successful application the noise emissions from the site will be set by the EPA. Reference has therefore been made to the EPA's document - *Guidance Note for Noise: Licence Applications, Surveys and Assessments in relation to Schedules Activities (NG4), Jan 2016*.

NG4 sets out recommended methodology for selecting the noise criteria for which the environmental noise emissions from a facility should be assessed against. To follow this methodology, firstly the facility's location must be assessed to determine if it is in a *"Quiet Area"* and secondly, depending on the result of this, the noise survey results from the area may require examining to see if the area is in an *"Area of Low Background Noise".*

The methodology in NG4 has been followed and in line with this it is considered that the following noise criteria in terms of the noise emissions from the site at the nearest noise sensitive receptors would be as follows;

- Daytime Noise Criterion **55 dB ($L_{Ar,T}$[1]);**

[1] The Rated Noise Level, equal to the LAeq during a specified time interval (T), plus specified adjustments for tonal character and/or impulsiveness of the sound.

- Evening Noise Criterion **50 dB ($L_{Ar,T}$);**
- Night-time Noise Criterion **45 dB ($L_{Ar,T}$).**

9.3.2 Existing Road Traffic Noise

At the moment in Ireland there are no specific guidelines or limits relating to traffic noise which are applicable in this instance. In the absence of such and to provide a measure on the impact of the traffic noise which is currently associated with NCCCL to the receiving environment Table 9.1 can be used to assess the impact of any changes in road traffic noise levels.

Change in Noise Level – dB(A)	Impact
➢ 10	Major Adverse
5 – 9.9	Moderate Adverse
3 – 4.9	Minor Adverse
0.1 – 2.9	Negligible

Table 9.1 Subjective change in road traffic noise.

9.4 NCCCL SITE LOCATION & RECEIVING ENVIRONMENT

The NCCCL site is situated immediately to the south of Kanturk town centre. It extends for approximately 350m in a north-west / south-east orientation. The western boundary of the site is adjacent to or shared in some instances with a series of private dwellings for most of its length. The River Allow flows next to the east boundary and immediately across from this there is a public park. Above the park there are dwellings on elevated ground adjacent to the R576 overlooking the creamery. The southern side of the site is used as the main access route for road tankers and there is agricultural land immediately to the south of it. The site's north boundary is also used as an access point for road tankers and it is adjacent to residential dwellings. To the north of this boundary is the centre of Kanturk town.

9.4.1 Noise Survey Personnel

The noise surveys were carried out by Niall Vaughan (CLV Consulting Limited). Niall is an Acoustic Consultant with over fifteen years of experience. He holds a BSc from the University of Bradford in Environmental Science and a diploma in acoustics from the Institute of Acoustics of which he is a member.

9.4.2 Noise Survey Instrumentation

The measurements were conducted using an NTI Audio XL2 Class 1 Sound Level Meter (SLM) - serial number A2A-10989-EQ. Before and after the survey it was check calibrated using a Casella Cel 120 Acoustic Calibrator (AC) - serial number 3921077. The SLM was fitted with a 90mm manufacturer's windshield

9.4.3 Noise Survey Procedure

Two environmental noise surveys were carried out during the months of September and October over representative twenty-four hour periods. One of these surveys took place while the site was in normal production and the second one took place during a site shutdown. There were some ancillary plant items operating during the shutdown period but their impact on the noise environment was slight. The surveys were carried out in accordance with the following documents;

The surveys were carried out at five monitoring locations over daytime, evening and night-time periods. These periods are defined in NG4 as 0700hrs to 1900hrs, 1900hrs to 2300hrs and 2300hrs to 0700hrs.

The monitoring periods at each location were fifteen minutes and they were carried out on a cyclical basis. There were three periods for the daytime monitoring, one for the evening and two for the night-time at each location.

The SLM's microphone was typically 1.4m above ground and the SLM was always positioned at least 3.5m from reflecting surfaces.

9.4.4 Noise Indices and Terminology

The following indices and terminology are used in this assessment;

L_{Aeq} – is the A weighted sound pressure level measured in dBs. It is a measure of the total sound energy measured over a period of time.

L_{A10} – is the A weighted noise level which is exceeded for 10% of the monitoring period. In environmental monitoring it is used where appropriate as a useful indicator of road traffic noise.

L_{A90} – is the A weighted noise level which is exceeded for 90% of the monitoring period. In environmental monitoring it is used where appropriate as a useful indicator of steady state background noise.

Tonal Noise Sounds which cover a range of only a few Hz which contains a clearly audible tone, i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

Impulsive Noise A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

9.4.5 Noise Survey Times

The noise surveys when the creamery was operating took place over the following dates and times;

The noise surveys when the creamery was shut down took place over the following dates and times;

9.4.6 Noise Survey Meteorological Conditions

The meteorological conditions over the course of the survey periods are presented below in Table 9.2.

Date	Wind – m/s		Temperature Range - °C	Barometric Pressure - hPa	Relative Humidity - %
	Speed	Direction			
13th Sep 2016	2.1 - 2.6	NW	11 - 16	1015	68
9th / 10th Oct 2016	0.9 – 1.8	SE - S	11 - 16	1030	72
11th / 12th Oct 2016	N/A	N/A	10 - 15	1030	75

Table 9.2 Meteorological conditions during the environmental noise surveys.

9.4.7 Noise Monitoring Locations

The noise monitoring was conducted at five locations which are referenced in this report as NSL1 to NSL5. All five of these locations are regarded as noise sensitive locations and each one is described in turn below. Figures 9.1 to 9.5 provide pictures of the monitoring locations and Figure 9.6 shows them overlaid on an OS map of the area.

Location NSL1 – South Boundary

Location N1 is situated with a clear line of sight to the BioAtlantis building. It is in close proximity to their office and in line with the main road tanker entrance. Due to its close proximity to the nearby residences this location would be considered a noise sensitive location. A picture of NSL1 is provided in Figure 9.1 below.

Figure 9.1 Location NSL1

Location NSL2 – West Boundary - (Noise Sensitive Location)

Location N2 is situated on the west boundary at the entrance to the NCCCL staff car park and opposite the casein building. It is adjacent to a private residence and would be considered a noise sensitive location. A picture of NSL2 is provided in Figure 9.2 below.

Figure 9.2 Location NSL2

Location NSL3 – North Boundary - (Noise Sensitive Location)

Location N3 is situated at the northern entrance to the site opposite the milk reception area. It is close to a private dwelling and would be considered a noise sensitive location. A picture of NSL3 is provided in Figure 9.3 below.

Figure 9.3 Location NSL3

Location NSL4 – East Boundary - (Noise Sensitive Location)

Location N4 is situated approximately 100m to the east of NCCCL on elevated ground overlooking the NCCCL site. It is opposite the entrance to the residential estate St. Theresa's Place and would be considered a noise sensitive location. A picture of NSL4 is provided in Figure 9.4 below.

Figure 9.4 Location NSL4

Location NSL5 – East Boundary - (Noise Sensitive Location)

Location N5 is situated next to the River Allow approximately 50m from the NCCCL site. It is located in the town's public park and would be considered a noise sensitive location. A picture of NSL5 is provided in Figure 9.5 below.

Figure 9.5 Location NSL5

Note: two monitoring locations were selected to the east of the site because it was thought that NSL4, while closer to the NCCCL site, may at times be in the site's acoustic shadow.

Figure 9.6 below shows the layout of the site in red and the approximate positions of the noise monitoring locations.

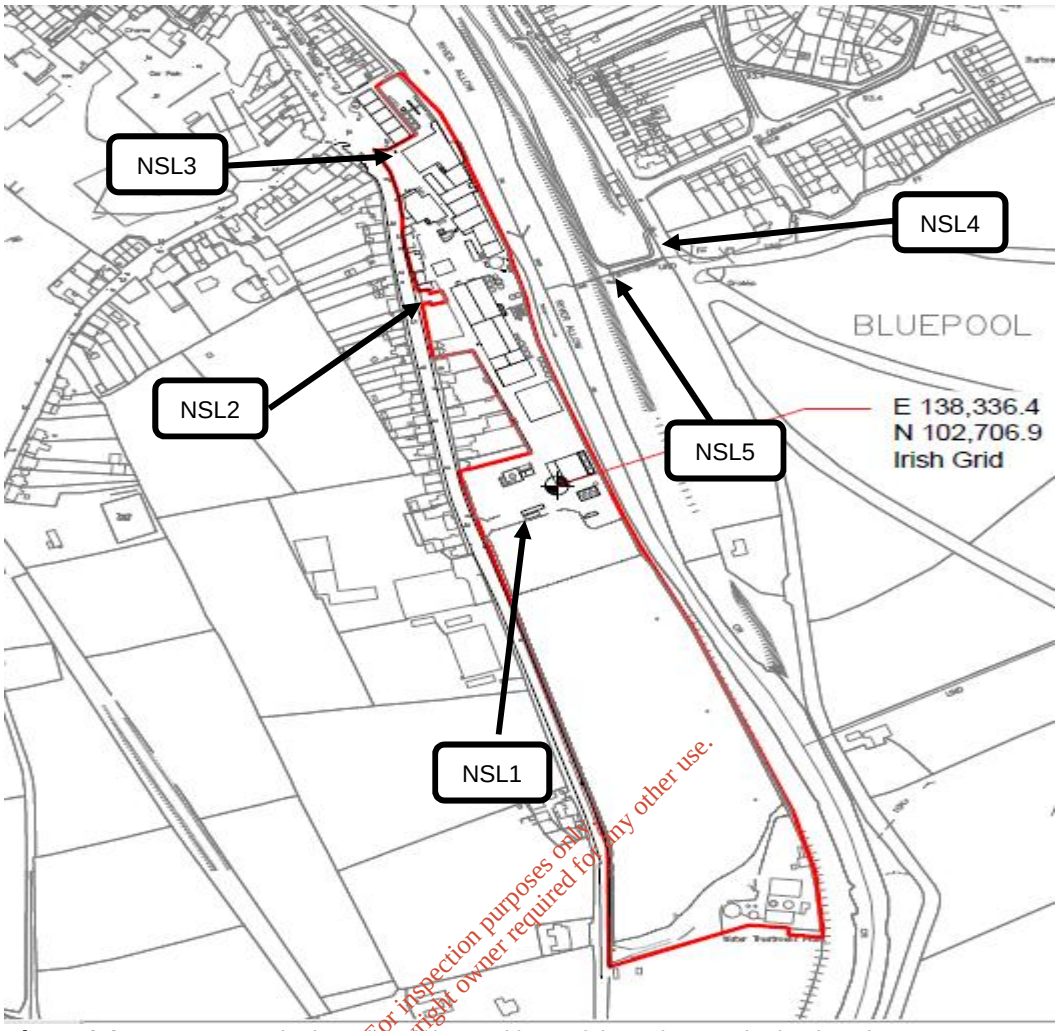

Figure 9.6 NCCCL site in red and the positions of the noise monitoring locations.

9.5 NOISE SURVEY RESULTS

The results from the noise surveys with and without NCCCL operating are presented in Tables 9.3 to 9.7 below.

9.5.1 Location NSL1 - Survey Results

Table 9.3 below details the noise survey results from location NSL1.

N1	Irish Grid Ref	Sound Pressure Levels (dB)							
		NCCCL Operating				NCCCL Shutdown			
		Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}	Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}
Day	138313E 102683N	1113	60	64	56	1300	55	56	53
		1255	61	63	56	1432	64	69	51
		1500	64	67	57	1607	65	69	52
Eve		2130	64	65	51	2100	63	63	49
Night		2305	59	54	47	2300	59	49	45
		2350	48	48	47	0050	59	48	45

Table 9.3 *Noise survey results from location NSL1.*

When the creamery was in operation noise emissions from the BioAtlantis production building were the dominant source of noise for the daytime and evening periods. The main source of the noise emission from BioAtlantis was the open roller door on the southern façade of their building. The noise profile from the site was steady state and broadband. During the night-time periods the BioAtlantis site was not in operation and the noise environment was dominated by road traffic noise. The creamery was audible as a background source during the night-time periods.

During the shutdown period road traffic noise was the dominant source of noise for the first daytime period and the two night-time periods. During the other periods maintenance work, un-related to the creamery and BioAtlantis, was the main source of noise.

9.5.2 Location NSL2 - Survey Results

Table 9.4 below details the noise survey results from location NSL2.

N2	Irish Grid Ref	Sound Pressure Levels (dB)							
		NCCCL Operating				NCCCL Shutdown			
		Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}	Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}
Day	138257E 102814N	1054	65	68	60	1318	66	71	46
		1237	67	71	60	1450	66	71	46
		1420	67	70	60	1625	65	70	43
Eve		2148	63	63	61	2118	59	63	41
Night		2323	61	61	58	2318	57	58	41
		0008	62	63	62	0108	41	42	40

Table 9.4 *Noise survey results from location NSL2.*

The daytime and evening noise levels during the ambient survey were dominated by R579 road traffic. NCCCL was audible as a steady state background noise source during these periods. During the night-time monitoring periods, due to the reduction in the volume of road traffic the NCCCL facility was the most audible noise source. Noise emanating from the casein building was the primary noise source from within the site.

R579 road traffic noise was the only source of noted during all of the monitoring periods during the background survey.

9.5.3 Location NSL3 - Survey Results

Table 9.5 below details the noise survey results from location NSL3.

N3	Irish Grid Ref	Sound Pressure Levels (dB)							
		NCCCL Operating				NCCCL Shutdown			
		Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}	Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}
Day	138233E 102974N	1036	64	66	60	1335	63	67	54
		1219	66	68	61	1508	64	68	53
		1355	66	68	61	1643	64	68	53

Eve		2206	58	61	54	2135	60	64	46
Night		2341	56	56	54	2336	56	57	46
		0026	55	55	54	0127	47	50	44

Table 9.5 *Noise survey results from location NSL3.*

The most audible source of ambient daytime and evening noise at location NSL3 was R579 road traffic noise. The NCCCL site was generally inaudible but vehicles entering and leaving the NCCCL milk intake area contributed slightly to the noise levels. A tonal component was noted at 10kHz during the evening period. This tone appeared to be emanating from an air release in a neighbouring building. During the night-time periods NCCCL was audible as the primary source. The noise profile from the site was steady state and broadband. The refrigeration unit for the cold store was the main source from within the site.

The noise environment during the background noise survey was mainly influenced by R579 traffic noise. There were some contributions from pedestrian traffic but their impact was slight.

9.5.4 Location NSL4 - Survey Results

Table 9.6 below details the noise survey results from location NSL4.

N4	Irish Grid Ref	Sound Pressure Levels (dB)							
		NCCCL Operating				NCCCL Shutdown			
		Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}	Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}
Day	138388E 102952N	1017	69	72	59	1355	66	70	54
		1201	67	71	60	1529	64	68	55
		1334	66	70	60	1707	64	69	55
Eve		2226	63	66	56	2154	60	62	54
Night		2302	59	58	55	2355	60	58	53
		0050	55	56	55	0148	53	53	52

Table 9.6 *Noise survey results from location NSL4.*

The ambient daytime and evening noise environment was dominated by R576 road traffic noise. During these periods the NCCCL site was audible as a steady state background source of noise. During the night-time periods road traffic noise remained to be the dominant source however the NCCCL site was far more audible on account of the reduction in the volume of traffic. During the second night-time period the SLM was paused for the duration of local traffic movements and the site was audible as the main source. The River Allow was perceptible in the background.

The noise levels while the site was shutdown were dominated by R576 traffic noise. The River Allow was audible as a background source. The evening and night-time levels were lower than the daytime because of the reduction in the volume of traffic.

9.5.5 Location NSL5 - Survey Results

Table 9.7 below details the noise survey results from location NSL5.

N5	Irish Grid Ref	Sound Pressure Levels (dB)							
		NCCCL Operating				NCCCL Shutdown			
		Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}	Time - Hrs	L_{Aeq}	L_{A10}	L_{A90}
Day	138343E 102935N	1000	64	65	64	1412	60	61	59
		1133	64	64	63	1546	60	61	59
		1316	64	64	63	1724	60	61	59
Eve		2243	61	62	60	2211	57	58	56
Night		2320	62	62	61	0013	58	58	58
		0107	61	62	61	0204	59	59	59

Table 9.7 *Noise survey results from location NSL5.*

NCCCL was the primary source of noise at NSL5 while the site was in operation. The noise profile from the site was steady state and broadband. Distant R576 traffic noise and the River Allow were audible as background noise. Birdsong was present as an intermittent daytime noise however, its impact on the noise environment was marginal. The SLM was paused for the duration of local traffic movements during the second night-time period.

During the plant shutdown the River Allow was the primary source of noise for all of the monitoring periods. R576 traffic noise was perceptible as a distant source but its impact was slight.

9.6 SUMMARY OF THE NOISE SURVEY

The results of the noise survey indicate that road traffic noise and noise emissions from the NCCCL site are the two most audible noise sources in the area. There were a number of background sources noted but the contributions from them was slight.

During the night-time periods the volume of road traffic had decreased significantly and at all of the NCCCL was noted as a source of noise. During these periods it was concluded that the noise emissions from the site would not comply with the EPS's standard 45dB night-time criterion.

9.7 IMPACT FROM THE EXISTING SITE TO THE RECEIVING ENVIRONMENT

9.7.1 Operational Plant

As previously stated this assessment deals with the existing noise levels from the site as there are no current plans for extra development at the site.

From the recent environmental noise survey, it was observed that the site was audible during all three monitoring periods at all of the locations.

At NSL1 noise levels of 64dB were recorded during the daytime and evening period and with the BioAtlantis facility noted as the dominant source. These values are in excess of daytime and evening noise criteria. BioAtlantis does not operate during the night-time hours however, NCCCL was audible during the second night-time

period as a background source. The measured L_{A90} level of 47dB is considered representative of the noise from NCCCL at this location. This value is in excess of the 45dB night-time criterion.

As the operations at the site are steady state the second night-time L_{A90} values provide a more accurate measure of the noise from NCCCL as there was less of a contribution from road traffic noise. As the night-time criterion of 45dB is also the most stringent compliance with this value is also the primary objective.

Table 9.8 below provides the night-time L_{A90} values at the five monitoring locations.

Location	Night-time $L_{A90\ Value}$ for the second Period	Nigh-time Criterion	Compliance - Y/N
N1	47	45	N
N2	62		N
N3	54		N
N4	55		N
N5	61		N

Table 9.8 *Second night-time L_{A90} value.*

At NSL1 the measured L_{A90} level of 47dB is considered representative of the noise from NCCCL at this location. This value is in excess of the 45dB night-time criterion.

At NSL2 the second night-time L_{A90} value was 62dB which is in excess of the night-time criterion. NCCCL was the dominant source during this period and the only source of note. Noise emanating from the casein building and from its exhaust were observed as the two primary sources.

At NSL3 NCCCL's cold store refrigeration plant was the most audible source at this location. The L_{A90} value for this period was 54dB which is in excess of the night-time criterion.

At location NSL4 the L_{A90} value for the second night-time period was 55dB which is in excess of the night-time criterion. This value is considered representative of the noise emission from the site and the two most audible sources were the exhaust on the casein building and the casein building itself.

At NSL5 NCCCL was regarded as the main source of noise during the night-time periods. The L_{A90} value for both night-time periods was 61dB which exceeds the 45dB night-time criterion.

9.7.2 Traffic Noise

TG Lenihan and Co Ltd have carried out a traffic study with regard to the existing traffic generated by NCCCL. This study concluded that NCCCL has no notable additional impact on traffic increase in the town. When it is considered that an increase of 25% in the volume of traffic would result in an increase of less than 1dB it is reasonable to conclude that the traffic noise generated from the existing site is negligible in accordance with Table 9.1 of this assessment.

9.8 CONCLUSIONS AND MITIGATION MEASURES

Section 9.7 of this report indicates that the noise emissions from the NCCCL site would currently not meet compliance with standard EPA noise criteria. In order to

comply with the EPA criteria noise mitigation measures will be required at the creamery.

At location NSL1 the BioAtlantis site was noted as the dominant source for the daytime and evening periods. The noise from BioAtlantis was 9dB and 14dB above these periods respectively. It was observed during the survey that the roller shutter door used to access BioAtlantis production was open during these periods and this was the main source of noise escaping from there. Keeping this door closed at all operating times should ensure that the noise emissions will comply with daytime and evening noise criteria of 55dB and 50dB respectively. There were also a number of open penetrations in the building used to accommodate services. The open areas should be filled with material offering the same sound insulation performance as the building fabric to prevent fugitive noise emissions.

At location NSL2 noise from NCCCL was 62dB which is 17dB above the night-time criterion. The two dominant sources at this location were the casein exhaust which is on top of the casein building and noise breakout through the roof of the casein building. It is understood that is planned to replace the existing attenuator on the casein exhaust with one which will achieve the required level of attenuation. To attenuate the noise from the casein building remediation work is required to the roof. To reduce this to an appropriate level it is recommended that the existing roof be upgraded with one which provides a suitable level of attenuation.

The noise emissions from NCCCL at NSL3 were 9dB above the 45dB night-time criterion. The main source at this location was the refrigeration unit for the cold store which has a direct line of sight to the NSL. To bring the noise from the creamery in line with the night-time criterion it is recommended that the refrigeration unit be screened from the NSL with a proprietary barrier.

The noise mitigation measures for NSL4 are addressed in the mitigation measures for N5. The impact from the creamery is greater at NSL5 and it will follow that the reductions which are experienced at N5 will be reflected at NSL4.

At Location NSL5 the noise emissions from the NCCCL site were 61dB. In common with NSL2 the two most audible sources at this location were the casein exhaust and the emissions through the roof of the casein building. The mitigation measures for these two sources have already been dealt with in paragraph 3 of this section. NSL5 has a direct line of sight to NCCCL's ancillary plant items and it was noted that noise emanating from the open roller door into the casein building, the cooling tower for the Niro and the boiler house were perceptible. The roller door should be maintained shut during production to prevent these emissions and it is understood that the cooling tower for the Niro and the boiler are due for replacement. Meeting compliance with the night-time criterion will be part of the selection for these two items. It was observed that the existing boiler house has a single skin metal roof and a number of open penetrations which are facilitating noise emissions. The penetrations should be sealed with material offering similar sound insulation performance to the building fabric and depending on the boiler selection the roof may also require noise abatement measures carried out on it.

From this assessment, it is believed that with careful and methodological planning the noise emissions form the site can be reduced to meet typical EPA noise criteria for a site such as this.

10.0 LANDSCAPE AND VISUAL ASSESSMENT

10.1 INTRODUCTION

This chapter of the Environmental Impact Statement (EIS) assessed the impact of the facility on the landscape and the visual environment. It has been prepared by T.J. Lenihan and Co.

The facility on Strand Street/Bluepool, Kanturk owned by North Cork Co-Operative Creameries Ltd (NCCCL) is a long established business in the town and is an acknowledged aspect of the town's landscape. This application will not require additional building or alterations to operations so no additional visual impact is anticipated.

10.2 METHODOLOGY

The assessment methodology for this section of the EIS has been completed in accordance with the EPA's 'Revised Guidelines on the information to be contained in environmental impact statements – Draft September 2015'. In this document the EPA has a breakdown of the characteristics (Section 3.7.7) that define an impact, and a set of structured terms and descriptions that define these characteristics. An extract from this section of the document is shown in **Table 10-1**.

Quality of Effects	
It is important to inform the non-specialist reader whether the effects is positive, negative or neutral	**Positive Effects** A change which improves species diversity; or the in removing nuisances or imp
	Neutral Effects A change which does not
	Negative/adverse Effec A change which reduces t species diversity or diminis damaging health or prope
Describing the Significance of Effects	
"Significance" is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Imperceptible** An effects capable of mea
	Not significant An effects which causes n without noticeable consec
	Slight Effects An effects which causes n without affecting its sensi
	Moderate Effects An effects that alters the with existing and emergin
	Significant Effects An effects which, by its ch aspect of the environment
	Very Significant An effects which, by its ch the majority of a sensitive
	Profound Effects An effects which obliterat
Describing the Magnitude of Effects	
	Extent Describe the size of the ar affected by an effect.
	Duration Describe the period of tim below)
	Frequency Describe how often the ef constantly – or hourly, dai
	Context Describe whether the exte established (baseline) con

Describing the Probability of Effects	
Descriptions of effects should establish how likey it is that the predicted effects will occur – so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably project if all mitigation measure
	Indeterminable Effects When the full consequences of
	'Worst case' Effects The effects arising from a proje fail
Describing the Duration of Effects	
'Duration' is a concept that can have differen: meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconcs to
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven yea
	Medium-term Effects Effects lasting seven to fifteen y
	Long-term Effects Effects lasting fifteen to sixty ye
	Permanent Effects Effects lasting over sixty years
Describing the Types of Effects	
Describing the types of effects	**Cumulative Effects** The addition of many smal effe
	'Do Nothing Effects' The environment as it would be out.
	Indeterminable Effects When the full consequences of
	Irreversible Effects When the character, distinctiver environmen: is permanently lost
	Residual Effects The degree of environmental ch measures have taken effect.
	Synergistic Effects Where the resultant effects is g
	Indirect Effects Effects that arise off-site or are of the developer (such as a qua
	Secondary Effects Effects that arise as a conseque will recuce the yield of mussels

Table 10-1: Section 3.7.7 for EPA Document. Definition of impacts.

This section of the report will locate the site, describe the facility's place in the town and the history of its development and conclude with a justification of the landscape and visual impact it has on the town.

10.3 EXISTING FACILITY

10.3.1 Site Location

The site is located on the East side of Strand Street/Bluepool (R579) in Kanturk. Strand Street is considered the busiest commercial retail location in Kanturk. The site is located on the west side of the river Allow. The immediate surroundings to the west of the NCCCL facility are retail and residential. The River Allow is adjacent to the entire east boundary of the site.

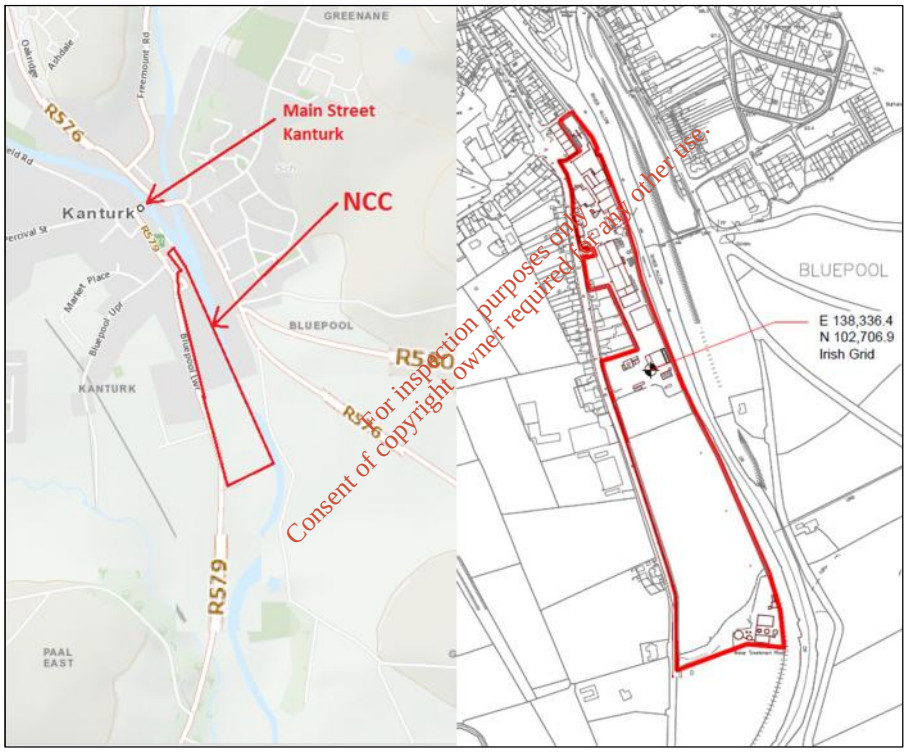

Figure 10-1 Site Location Map

10.3.2 Existing Land Use and Description of Facility

The NCCCL facility is used to produce various dairy products including liquid milk, dried milk powder, butter, cream, rennet casein and whey concentrates. The facility consists of office blocks, butter plants, cold stores, bottling plants, boiler houses, casein plants, drying units, waste water treatment plants and loading bays. Staff numbers are approximately 70 people at the present time. The east boundary of the site which lies along the River Allow is visible from the east side of the river and on approach from the R576. The west boundary of the site lies on Bluepool, Kanturk and lies across from residential terrace properties and is for the most part screened off from the public.

All process water is treated in the waste water treatment plant prior to discharge.

Kanturk Town is located in a flood plain, and NCCCL's facility lies in an area susceptible to flooding.

According to the "Kanturk Electoral Area Local Area Plan, Second Edition, January 2015" land has been zoned for different purposes including Residential, Recreation, Industry and Business in Kanturk Town. A section of NCCCL's property has been zoned for open space and recreation to the south, but the vast majority of the NCC CL site has not been zoned for any future development. The planned development of Kanturk is for areas which are not in close proximity to the site. This is essentially due to the area's susceptibility to flooding.

Figure 10-2 is an extract from the local area plan. All green areas represent areas zoned for open space and recreation. All other colours represent areas zoned for industry, commercial and residential. Kanturk is set to develop away from this facility.

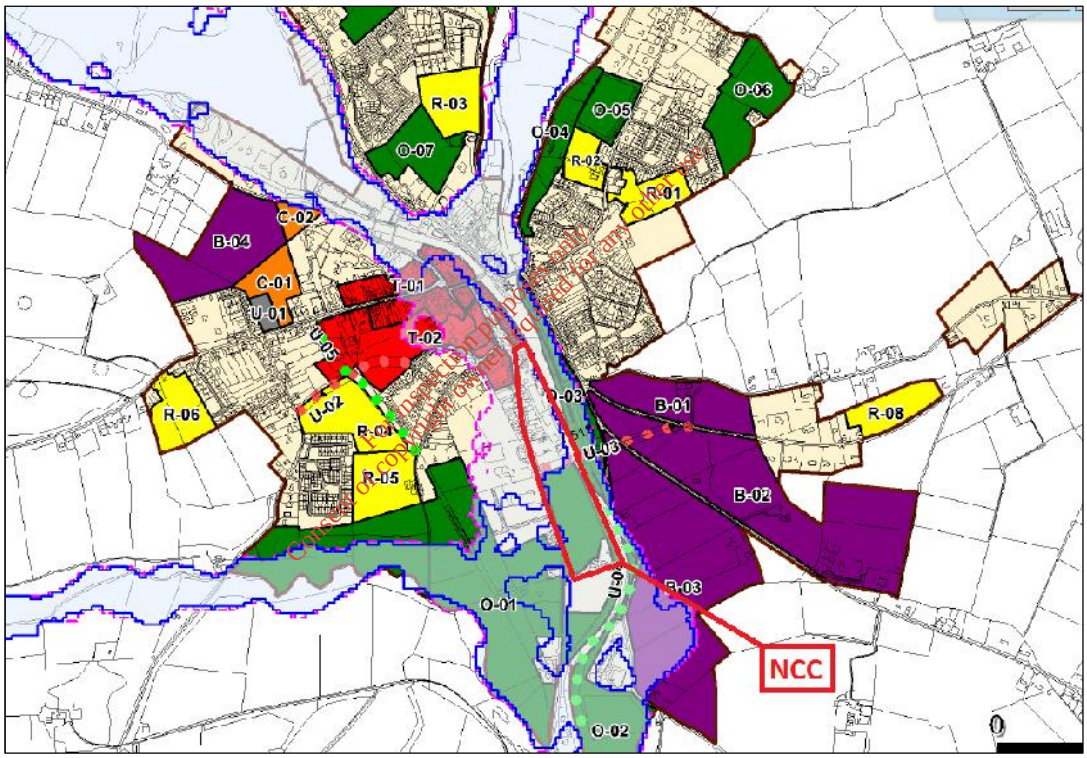

Figure 10-2 Extract from Kanturk Electorial Area Local Area Plan 2011.

10.4 ACTUAL AND POTENTIAL IMPACTS OF NCC ACTIVITY

A photo survey was undertaken by TG Lenihan & Co Ltd of the sites boundaries, entrances and surrounding area to determine the areas of greatest visual impact. The location of each photo is summarised in ***Figure 10-3***. All photos are presented in Appendix 10.1.

From the East side of the river, the NCCCL facility is visible from the public park and the R576. (Ref **Photo: 1**1 to **Photo: 3**).

From the West side of the facility on Strand Street and Bluepool some areas of the facility are visible from the road side. While operations are for the most part screened off, there are still some operations visible.

Artic Trucks are loaded at the main dispatch area at Strand Street (**Photo: 4** to **Photo: 8**). Loading operation are visible at roadside. Milk silos are also visible above terrace ridge level at Strand Street (**Photo: 4**)

Further south along Bluepool the skyline is interrupted by a tall drying unit at NCC, and the casein plant is also visible (**Photo: 9** to **Photo: 15**).

At the Bluepool entrance the Bio-Atlantis plant is also visible and slightly interrupts the skyline (**Photo: 16** to **Photo: 18**).

The most southern entrance of NCC is a large entrance in an undeveloped area and there is little visual impact here other than the entrance itself. (**Photo: 20**).

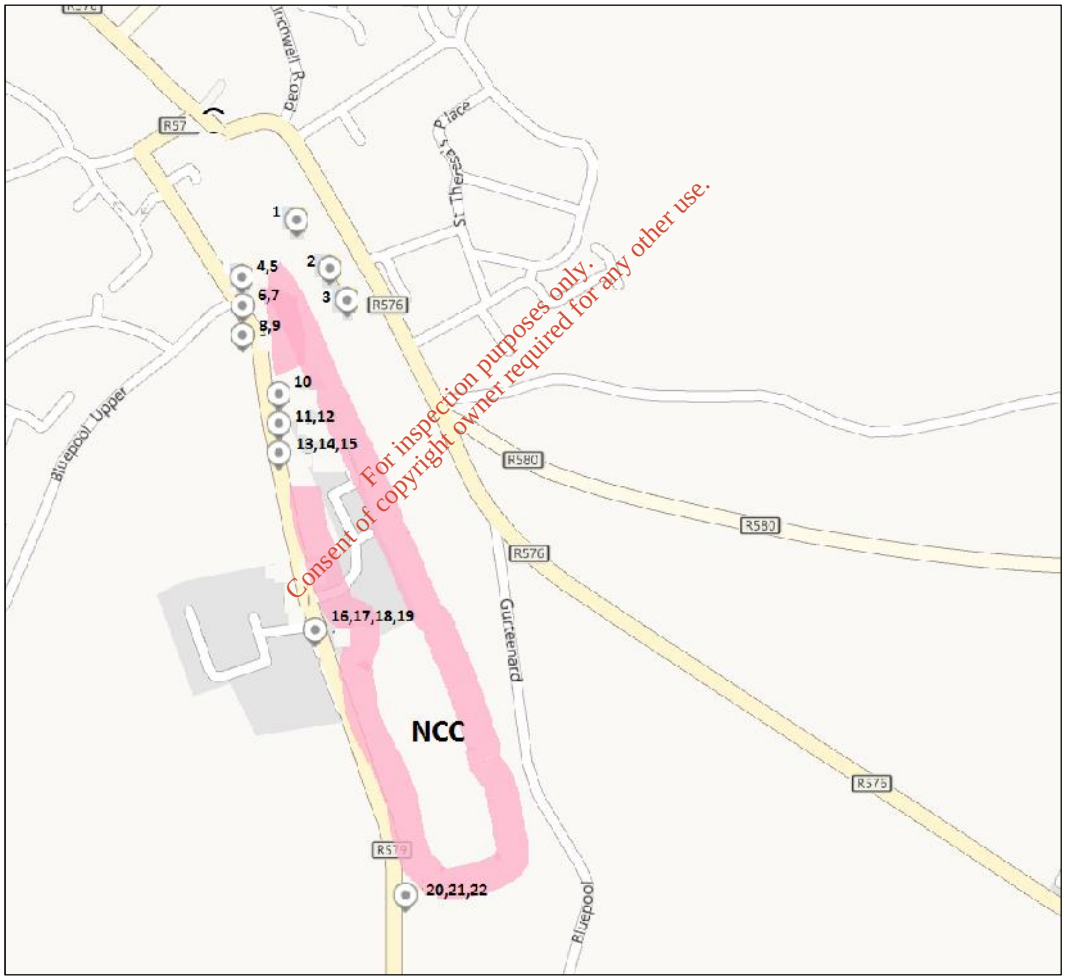

Figure 10-3: Photo Survey Picture Locations.

10.5 CONCLUSIONS

NCCCL is an existing business operational in Kanturk for over 85 years. The magnitude of site expansion was not properly anticipated at the time of set-up, and as a result the site has developed over the years in the town centre. This is an existing site and while the impact the current site has on the landscape is slightly

negative, as there is no building or development proposed within the licence application for which this EIS has been prepared, it will have no additional impact on the landscape. Therefore the existing site is deemed to have an overall long-term neutral impact on the landscape and visual characteristics of the area.

REFERENCES

- Revised Guidelines on the information to be contained in environmental impact statements – Draft September 2016 – EPA

- Kanturk Electoral Area – Local Area Plan – Second Edition January 2013 – Cork County Council

APPENDIX 10.1 - PHOTOS

Photo: 1 *View from East Public Park*

Photo: 2 *View from East Public Park*

Photo: 3 *View from East Public Park*

Photo: 4 *View From South Strand Street*

Photo: 5 *View From South Strand Street*

Photo: 6 *View From South Strand Street*

Photo: 7 *View from South Strand Street*

Photo: 8 *Photo 8 View from North Bluepool*

Photo: 9 *Photo 9 View from North Bluepool*

Photo: 10 *View from North Bluepool*

Photo: 11 *View from North Bluepool*

Photo: 12 *View from North Bluepool*

Photo: 13 *View from North Bluepool*

Photo: 14 *View from North Bluepool*

Photo: 15 *View of Staff Car Park on Bluepool*

Photo: 16 *View of Entrance - Bluepool*

Photo: 17 *View of Entrance Bluepool*

Photo: 18 *View Up-Street from Bluepool*

Photo: 19 *View Down-Street from Bluepool*

Photo: 20 *View of Southern Entrance*

Photo: 21 *View of Southern Entrance*

Photo: 22 *View Up-street from Southern Entrance along NCC boundary*

11.0 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

11.1 INTRODUCTION

This section deals with the archaeological, architectural and cultural heritage resource of the site. It sets out the methodology, a baseline of the receiving environment, and an assessment of the impact of the proposal.

There is no building involved in the proposal and this report is compiled as a part of an application for an Industrial Emissions Licence for North Cork Co-Operative.

11.2 METHODOLOGY

The following methodology was used in compiling this section of the EIS:

- A desktop study using historical and cartographic source;
- A site walkover undertaken in September 2016;
- A review of the Sites and Monuments Record (SMR), the Record of Monuments and Places (RMP) for County Cork.

11.3 RECEIVING ENVIRONMENT

The site under review (Figure 12.1) lies in the southern outskirts of the urban area of Kanturk and comprises both an area of built structures (brownfield) at the northern end of the site and pasture land (greenfield) at the southern end.

Figure 11.1 The site location outlined in blue

The site stretches from the southern end of Strand Street and is defined on the western end by the street known as Bluepool Lower and on the eastern side by the River Allow. A water treatment plant is located at the southern corner of the site.

The North Cork Co-Operative Creameries site has developed along the western bank of the River Allow (Figure 11.2-11.3) from its original foundation at the southern end of Strand Street.

Figure 11.2 The banks of the River Allow looking S. from the E bank

Figure 11.3 The banks of the River Allow looking N from the E bank; the site under review is on the W bank

The natural environment of the site is a strip of level ground on the western riverbank, but slightly higher ground flanks the River Allow at the north-western part of the site (urban area). The ground becomes more level and low-lying towards the south.

Strand Street was laid out in the later eighteenth century and in the early nineteenth century. A Market House stood on Strand Street since the mid seventeenth century but the present building dates to 1839. The Banteer Road (R579) was developed in the late eighteenth/early nineteenth century when a line of small cottages was built on both sides and this street became known as Bluepool Lower Street.

A rectangular unit of land appears to have been allocated for housing and Bluepool Street ran diagonally through this strip of land and consequently the terraced houses lining the street had gardens to the rear; these were longest at the northwest and southeast sides and shortest at the south-west and northeast (Figure 11.4).

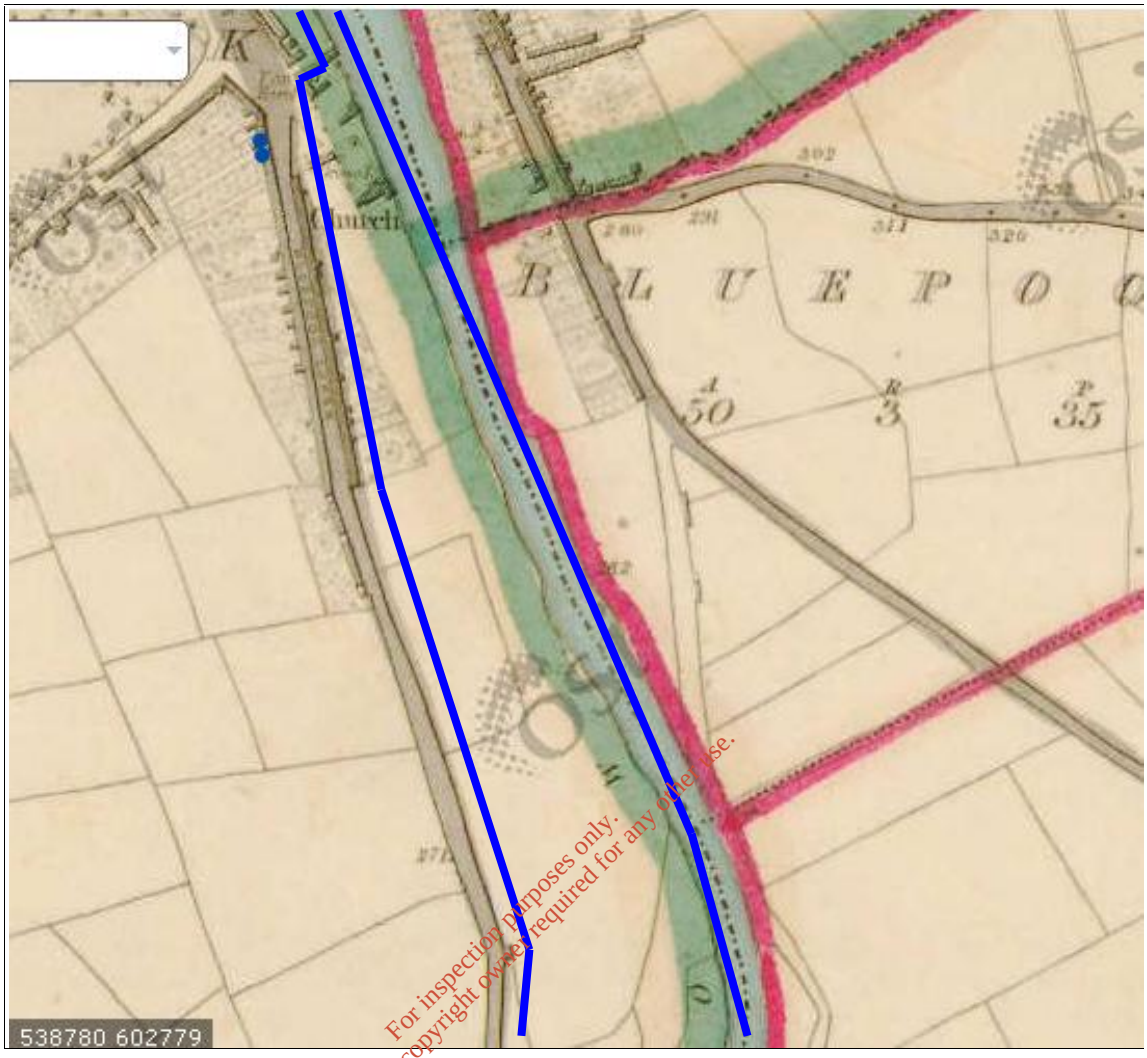

Figure 11.4 The first edition Ordnance Survey Map (1829-41), approximate site boundary outlined in blue

A church and associated graveyard are shown on the first edition Ordnance Survey map (1829-41). The church appears to have been a small rectangular structure aligned east-west with its eastern wall on the riverbank. A rectangular graveyard lay to the north of the church (see Figure 11.5 for detail).

Figure 11.5 Detail of the first edition Ordnance Survey Map (1829-41), showing the southern end of Strand Street and the western end of the site under review. The church and graveyard that one stood by the riverbank are shown on this map.

The church is not shown on the second edition of the Ordnance Survey map (1897-1913) but the rectangular enclosure that once defined the graveyard is still visible. Neither the church nor graveyard are depicted or named on the map (Figure 11.6 & 11.7). Neither the church nor graveyard are Recorded Monuments (Figure 11.1 & 11.15).

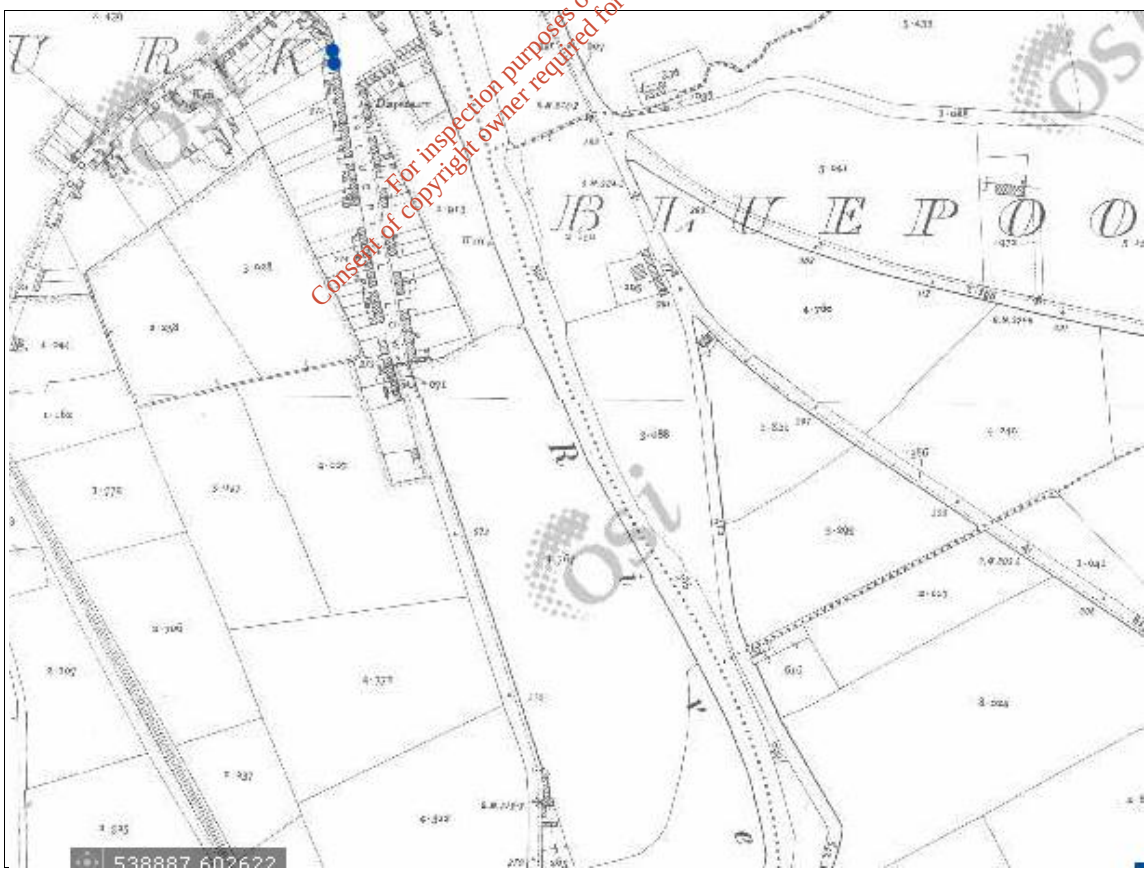

Figure 11.6 The second edition Ordnance Survey Map (1897-1913). Two of the terraced houses on the western side of Bluepool Lower are listed in the National Inventory of Architecture as being of 'Regional Importance', the blue dots indicate the location, (Reg No. 20810018 and Reg No. 20810019).

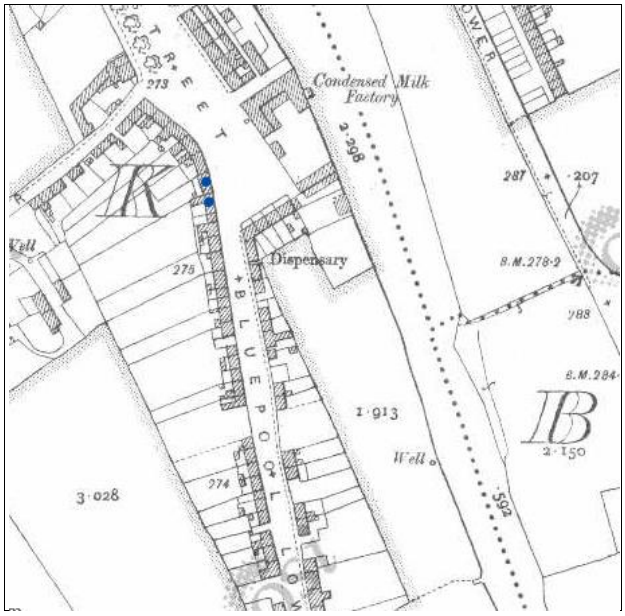

Figure 11.7. Detail of second edition Ordnance Survey Map (1897-1913) showing the western end of the site. The church and graveyard were gone by then but the rectangular enclosure where they stood can still be seen. One of the small terraced houses is named 'Dispensary'. A 'Condensed Milk Factory' represents the early development of the creamery site.

By the early-mid twentieth century the development of the creamery and associated milk processing plant was well underway (Figure 11.7). The early creamery buildings were developed to the south of Strand Street on the strip of riverbank lying behind (east) of the terraced houses.

Figure 11. 8 The Co-operative creamery site looking S from Stand Street. The original 'Condensed Milk Factory' is incorporated in the facade to the left of the photograph.

Having originated at the southern end of Strand Street, the creamery buildings were gradually developed southwards on the riverbank (Figure 11.9). The early twentieth century development appears to have largely occupied the location of the former church and graveyard.

Figure 11. 9 The early development of the creamery complex looking W from the E bank of the River Allow. The buildings were developed on the site once occupied by the former church and graveyard.

As the creamery continued to develop in the twentieth century many of the terraced houses on the eastern side of Bluepool Lower were removed and a range of buildings of early to mid twentieth century date (Figures 11.10 - 11.11) were constructed.

Figure 11.10 Some of the older buildings in the complex date to the late 19th/ early 20th century

Figure 11.11 Some of the former houses on Bluepool Lower are represented by only the front walls. While the 1950's style creamery buildings can be seen in the background.

Only one of the old terraced houses now survives on the eastern side of Bluepool Lower Street (Figure 11.12), while on the western side several of the old terraced houses remain intact. The creamery co-operative buildings of late twentieth and early twenty-first century date are generally large open plan, clad structures which have seen the co-operative buildings extend southwards into the former greenfield area between the riverbank and Bluepool Lower Street (Figures 11.12 - 11.13)

Figure 11.12 *On the S side of Bluepool Lower only one of the original cottages survive in a form close to the original (the house may once have been thatched). Most of the cottages have been replaced with modern houses and the complex of modern co-operative buildings can be seen in the background.*

The southern part of the site is characterised by the increasing divergence between the riverbank and Bluepool Lower Street/Banteer Road (R579) resulting in a field that is broader at the southern side (Figure 11.13).

Figure 11.13 The southern part of the co-operative property is in pasture and is a level field on the W banks of the River Allow

A field fence stretches from the riverbank to the Banteer Road and a water treatment plant is located between this fence and the southern boundary of the site that is defined by a concrete block wall (Figure 11.14).

Figure 11.14 A water treatment plant occupies the extreme SE corner of the site

There are no Recorded Monuments on the site under review (Figure 11.1 & 11.15). The nearest Recorded Monuments lie at distances of 100m or more from the site boundary, most of the sites in proximity are located in the historic urban area of Kanturk town. These include the *Market House* (CO023-329) in Strand Street, three bridges (CO023-076, CO023-298 & CO023-297002) and mill (CO023-297001). At the opposite side of the River Allow (east bank), in the townland of Pulleen, *a possible horizontal wheeled-mill* (CO023-319) was identified in the course of construction of a water treatment plant in 1992.

The National Inventory of Architectural Heritage (NIAH) does not list any buildings on the site as being of architectural merit. Two buildings on the western side (opposite side of the street from the site under review) of Bluepool Lower Street (blue dots of Figure 11.1) are listed as being of 'Regional Importance'; the buildings are a terraced

house (Reg. No. 20810019), built in *c.* 1800 and the 'Trades Union Hall' (Reg. No. 20810018) dated to 1881.

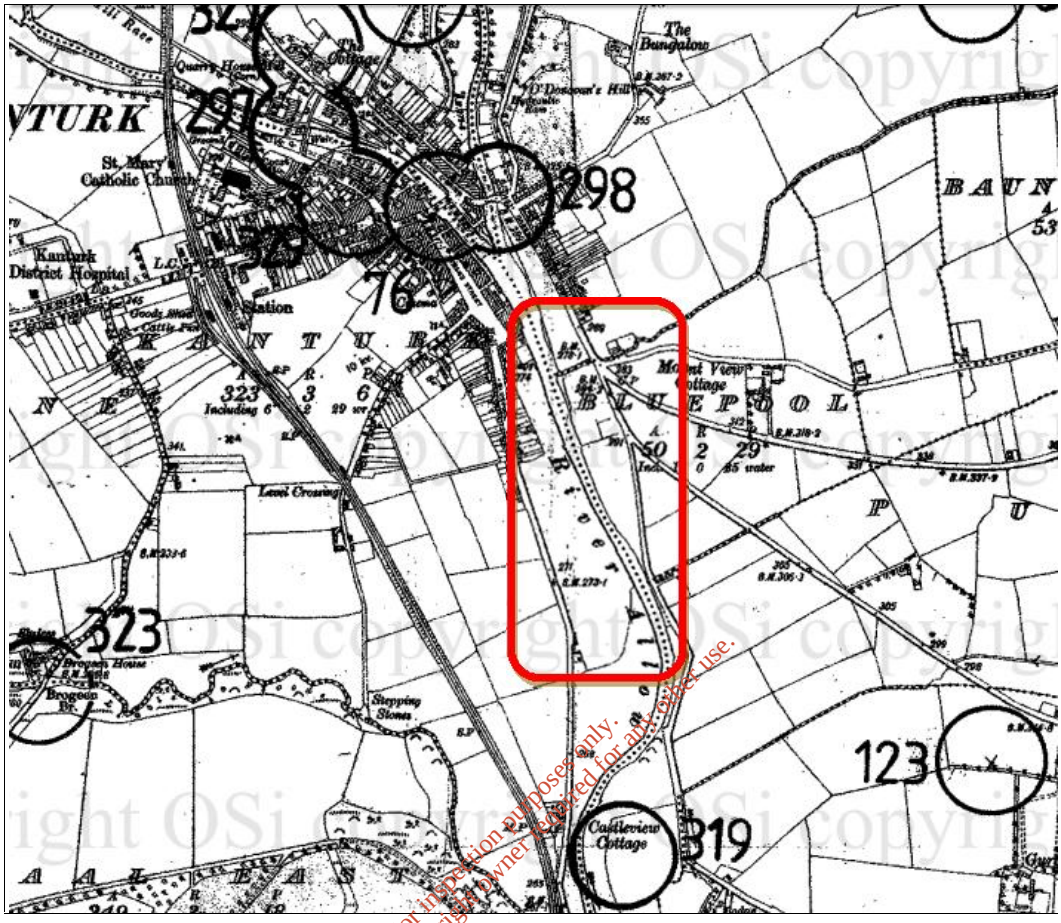

Figure 11.15 Sites and Monuments Record (on OS Map 6'' scale 1931, Sheet 23). The site under review is within the red area

11.4 CHARACTERISTICS OF THE DEVELOPMENT

The EIA is being completed to support an application for an Industrial Emissions Licence for North Cork Co-Operative. There is no building involved in the IED licence application.

11.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

There are no potential impacts on the archaeology, architecture or cultural resource of the site.

11.6 REMEDIAL AND MITIGATION MEASURES

There are no remedial and mitigation measures necessary for the proposal.

11.7 PREDICTED IMPACTS OF THE DEVELOPMENT

There are no predicted impacts associated with this proposal.

11.8 CUMULATIVE IMPACTS OF THE DEVELOPMENT

There are no cumulative impacts associated with this development.

11.9 REFERENCES

Archaeological Inventory of County Cork. Vol. IV-North Cork. Government of Ireland 2000

National Inventory of Architectural Heritage.

www.archaeology.ie

12.0 TRAFFIC AND TRANSPORTATION

12.1 INTRODUCTION

12.1.1 Scope

TG Lenihan and Co Ltd have been commissioned by North Cork Co-Operative Creameries Ltd (NCCCL) to collate information regarding existing traffic generated by NCCCL's facility in Bluepool, Kanturk Co Cork.

12.1.2 Objective

The objective of this report is to detail the existing traffic conditions in Kanturk while also detailing the traffic generated by operations of NCCCL in Bluepool, Kanturk. The report details the impacts NCCCL operations have on traffic flows in Kanturk town, and the impact they are likely to have in the future.

12.1.3 Study Methodology

- Locate the existing facility and describe its use.
- Break down the reasons for traffic congestion in Kanturk.
- Detail NCCCL's contribution to traffic congestion
- Justify why NCCCL's contribution to traffic congestion is minor compared to fundamental road infrastructure issues.

12.1.4 Reference Information

- Kanturk Electoral Area, Local Area Plan, Second Edition, January 2015
- Cork County Development Plan 2009

12.2 EXISTING FACILITY

12.2.1 Site Location

The Site is located on the East side of Strand Street/Bluepool (R579) in Kanturk. Strand Street is considered the busiest commercial retail location in Kanturk. The R579 is a major link to the N72(Mallow/Killarney) road. The site is located on the west side of the river Allow. The immediate surroundings to the west of the NCCCL facility are retail and residential to the north, and less dense retail to the south. The River Allow is adjacent to the entire east boundary of the site.

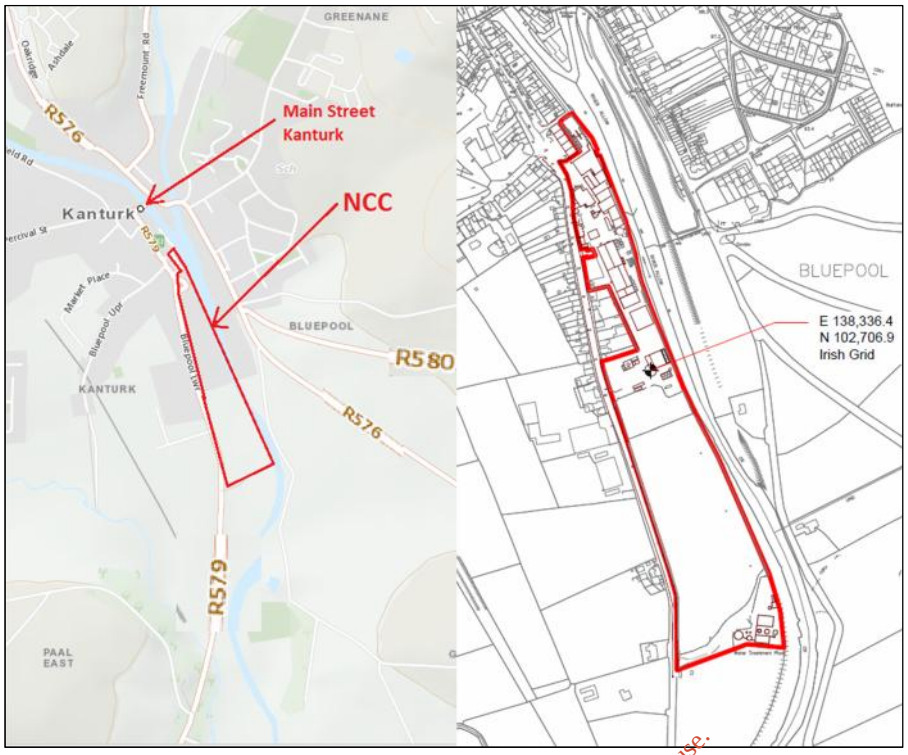

Figure 12-1 Site Location Map

12.2.2 Existing Land Use and Description of Facility

The NCCCL facility is used to produce various dairy products including liquid milk, dried milk powder, butter, cream, rennet casein and whey concentrates. The facility consists of office blocks, butter plants, cold stores, bottling plants, boiler houses, casein plants, drying units, waste water treatment plants and loading bays. Staff numbers are approximately 70 people at present time. Deliveries and collections for the facility approach from the north and south on the R579.

12.3 EXISTING TRAFFIC CONDITIONS

12.3.1 Existing Traffic Flows

Kanturk is to be developed as a centre for population and economic growth under the local area plan. The population of the town was set to increase from 1,915 – 2,400 in the period 2006 – 2020. (Table 9.6 – Cork County Development Plan). Kanturk is an active town and suffers from slight traffic congestion at peak times for a number of reasons.

Education: Traffic peaks on weekdays in the town between 8:00 and 9:00, and between 15:00 and 16:00. The main reason for such a trend is for the high numbers of school children. Kanturk is a relatively small town with a population of approximately 2,300 people, but the two secondary schools in the town also serve the smaller communities of the surrounding area including Kilbrin, Dromtariffe, Banteer, Castlemagner, Lismire, Freemount and Liscarroll.

Retail: Kanturk serves itself and all the aforementioned communities as a central retail location.

Agriculture: Kanturk is a central hub for the surrounding agricultural industry. A high percentage of heavy goods would be agricultural, including livestock, feed and plant machinery. Additionally, Kanturk Co-Op Mart operates weekly on Tuesdays from which large volumes of livestock traffic are generated, in particular because of the vast surrounding agricultural community. Tuesday traffic is particularly busy during summer months when livestock trading is at its highest.

Passing Trade: In addition to traffic due to Education, Agriculture and Retail, Kanturk generates a lot of passing trade as it lies on a number of major routes. The routes below encapsulate a large number of communities and many people.

- Charleville → Kanturk →Killarney
- Limerick → Kanturk → Killarney
- Macroom → Kanturk → Dromcolloher
- Cork → Kanturk → Listowel

Major Junctions in Town Centre: Each road into Kanturk coincides with other roads in the town centre. There has been no bypass development to alleviate traffic congestion in the town. As a result, major junctions in the town centre can be slow moving at peak times.

12.3.2 Existing Road Network

The R579 (Strand Street / Blue Pool) serves all traffic to NCCCL's facility. Road width varies between 6.5m and 8m. Its adjoining town centre roads are of similar width. The N72 to the south of the town is a national road which facilitates a large portion of NCCCL's traffic.

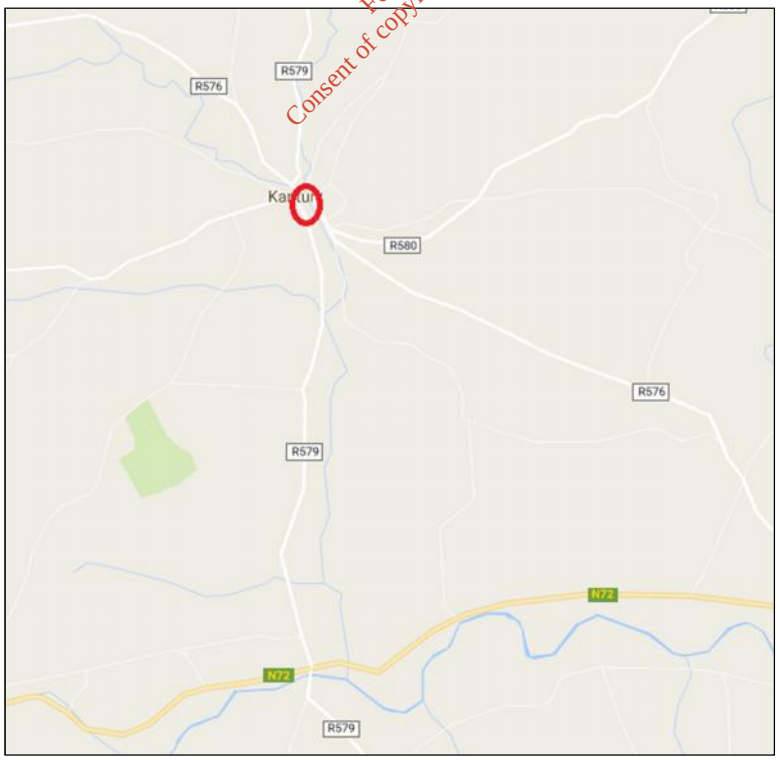

Figure 12-2: Road Network

12.3.3 Traffic Queues and Reasons

Traffic queues that occur daily have been plotted in **Figure 12-3** below. The most extensive of queues occurs inbound on the R579. This queue can be approximately 400m long at peak times and is as a result of poor traffic flow at the town centre junction circled below.

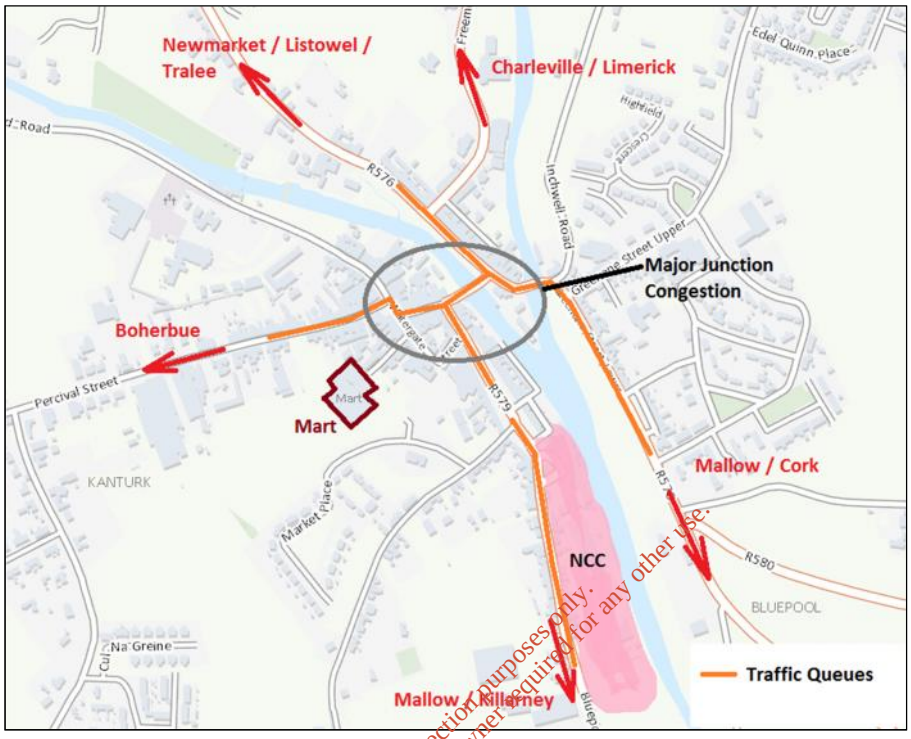

Figure 12-3: Traffic Congestion

12.3.4 Road Collisions

Information on road collisions was taken from the Road Safety Authority's website and is provided hereunder in **Figure 12-4**. There has only been one minor collision in the vicinity of the NCCCL facility in the period 2005 – 2013. This is a congested area of the town and this would be expected of any town centre over a nine year period.

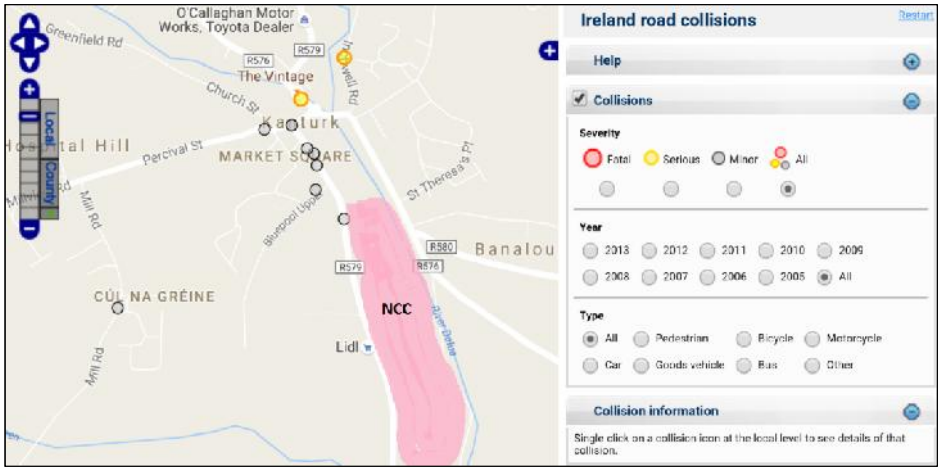

Figure 12-4: Road Collisions

12.4 TRIP DISTRIBUTION

12.4.1 Existing Facility Trip Distribution

The NCCCL facility operates year round, but there is a significant drop in activity during the winter milk period. Approximately 92% of Irish Dairy Farmers are summer milk producers, while only 8% are winter milk producers. The processors (NCCCL) are operating at peak during the months March – October during summer milking, but production troughs during months November – February during winter milking. NCCCL traffic approaches from either the south or the north, and tables below have been broken down as such. Vehicular traffic enters at one of two locations illustrated below in Figure 12-5.

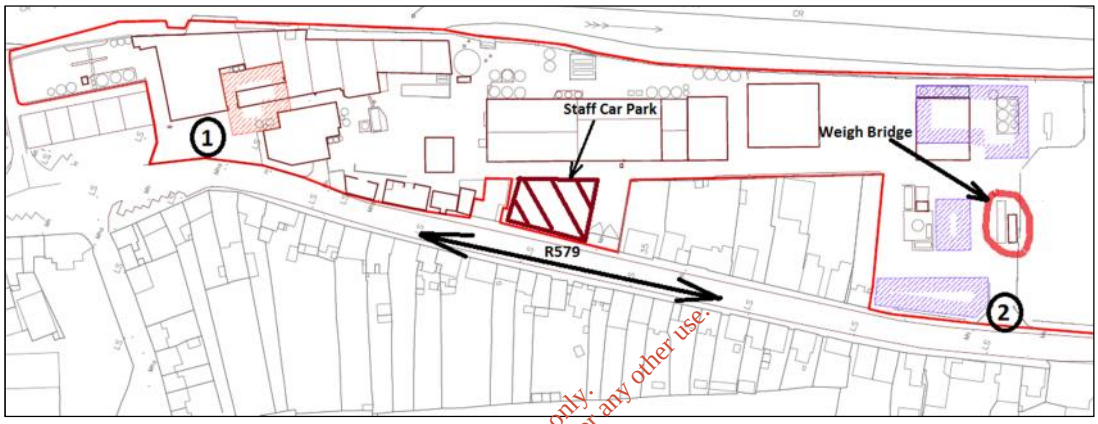

Figure 12-5: Entrance Locations

Vehicle	Artic Truck	Milk Lorry	Small Milk Truck	Staff Cars
From South	9.5	15	2	25
From North	-	15	1	25

Table 12-1: Daily NCCCL Traffic during Peak Period – March – October

Vehicle	Artic Truck	Milk Lorry	Small Milk Truck	Staff Cars
From South	0.8	1.25	0.25	7
From North	-	1.25	-	7

Table 12-2: Daily NCCCL Traffic during Trough Period – November - February

Milk Deliveries: The vast bulk of NCCCL traffic is incoming milk. Milk is delivered at location 1. These milk deliveries operate during extended working hours of between 6am and 6pm. At peak times these deliveries amount to 2.5 per hour. Milk is delivered using a one way system which is very convenient for drivers and eliminates disruption to public traffic. During peak times, ease of delivery is essential. Before the milk trucks offload, they must firstly enter at entrance 2 to be weighed at the weighbridge. All approaches to entrance 1 for offloading are made from the south. A plan view of the one-way system is shown in

Figure 12-6.

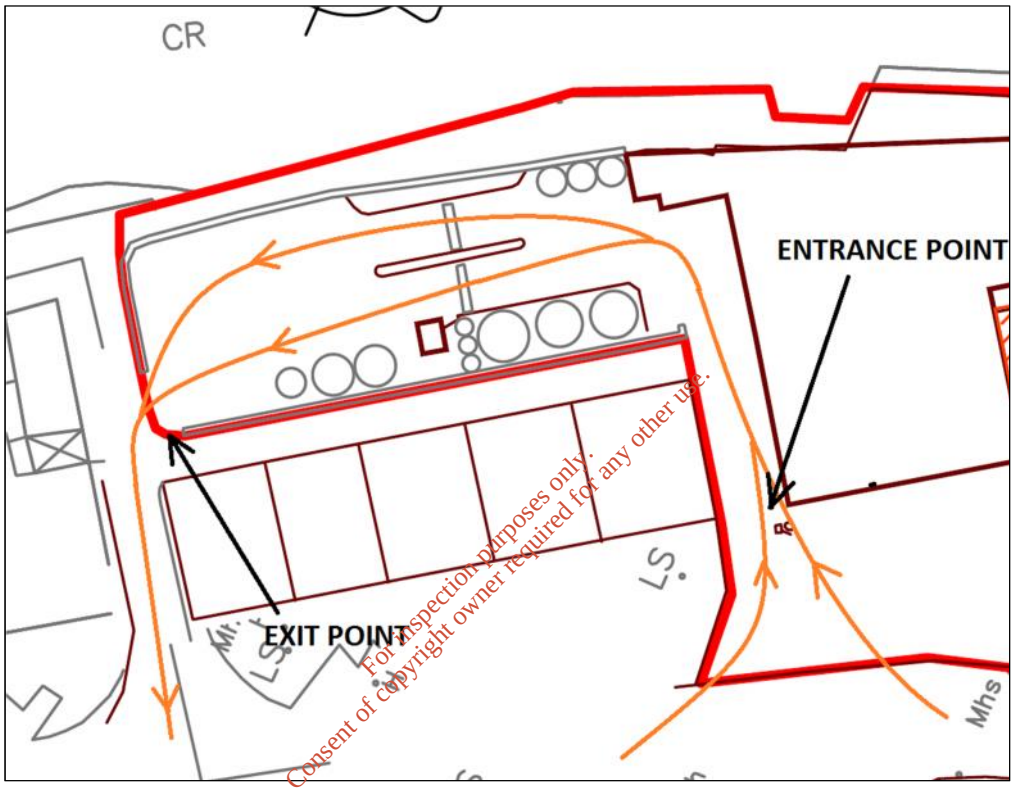

Figure 12-6: Milk Deliveries

Artic Trucks: These trucks arrive on site every day to both location 1 and 2 to collect product such as butter, casein and skimmed milk powder. During peak times, collection of this product amounts to 8.5 artic trucks per day. A single load of Sea-Weed is delivered to the Bio-Atlantis facility every day through entrance 2 which brings total incoming artic truck traffic to 9.5 per day. It should be noted that Bio-Atlantis is due to move to a new facility in approximately six months which will eliminate its contribution to traffic.

Staff Cars: Staff numbers are highest at peak times. A new staff car park has been constructed mid-way between both entrances (Figure 12-5) and will be enough to cater for all staff once it has been surfaced. This will completely eliminate any on-street parking contributions by NCCCL.

Small Milk Trucks: These are small 2 axle trucks for delivering milk bottles to local shops. Their contribution to traffic is minor, and these vehicles are easily manoeuvred.

12.4.2 Future Year Growth

While traffic in Kanturk is to grow in the coming years, NCCCL's contribution to that traffic will be negligible as we have been advised that staff numbers are not to increase, therefore production rates will remain stagnant.

Within the Kanturk Local Area plan, there is plans for a new downstream river crossing which should greatly alleviate traffic congestion problems and provide a new route for trucks and larger commercial vehicles. See **Figure 12-7**.

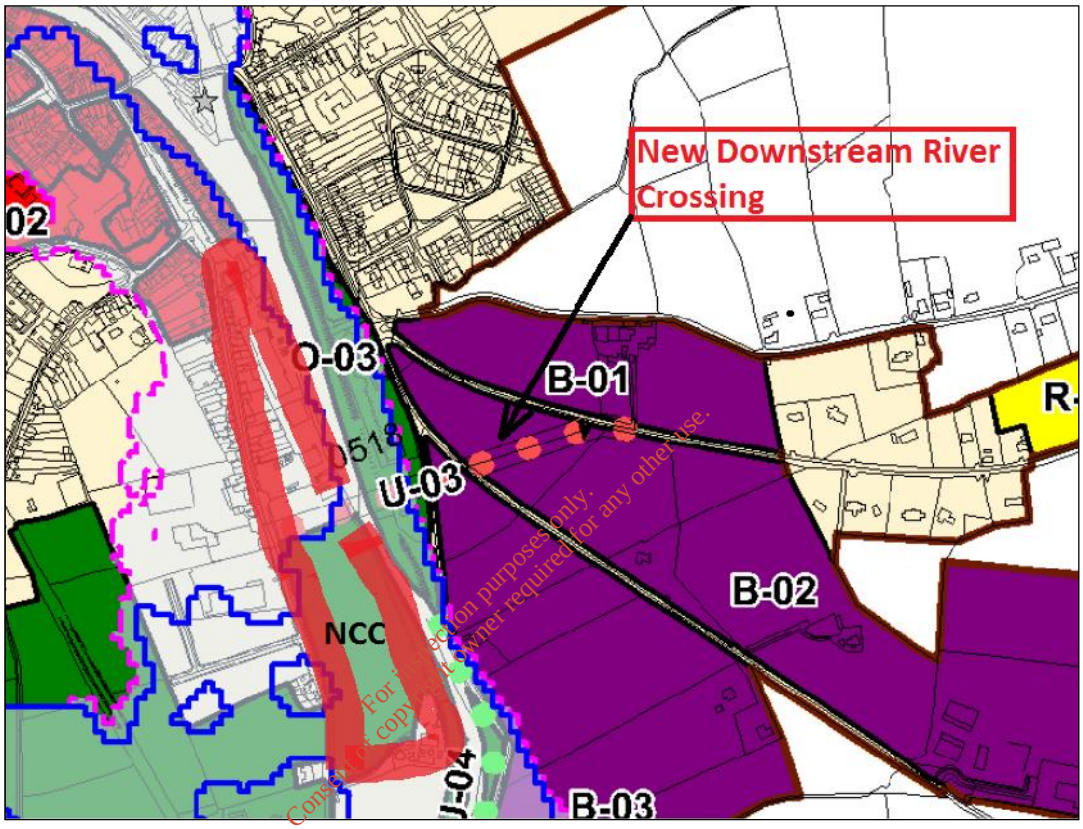

Figure 12-7: *Proposed new road from the "Kanturk Electoral Area Local Area Plan, Second Edition, January 2015"*

12.5 CONCLUSIONS

NCCCL is an existing business operational in Kanturk since 1928. Kanturk is a busy town due to retail, education and agriculture, and the town's traffic problems will need to be addressed in the future as traffic volumes grow. At present time, traffic problems in Kanturk are not so severe as to warrant immediate commissioning of the proposed traffic alleviation projects. Traffic in Kanturk is functioning with NCCCL's traffic contributions. Due to the fact that there is no foreseeable increase to staff and production, it needs to be assumed that NCCCL will have no notable additional impact on traffic increase in the town.

13.0 MATERIAL ASSETS

13.1 INTRODUCTION

This chapter evaluates the impacts, if any, which the development has had or will have on Material Assets as defined in the Environmental Protection Agency (EPA) 'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements'), 2003.

Material Assets are defined in the Environmental Protection Agency (EPA) advice notes on current practice in the preparation of Environmental Impact Assessments, 2003 as '*Resources that are valued and that are intrinsic to specific places... They may be of either human or natural origin and the value may arise for either economic or cultural reasons.'* The assessment of cultural heritage is discussed under Chapter 11 Archaeology/Cultural Impact; therefore, this Chapter evaluates the economic assets only. Economic assets have been addressed to some extent as part of Chapter 4 Socio Economic however additional detail will be discussed as part of this chapter under the following headings;

- Ownership and Access
- Local Settlement
- Electricity Supply
- Transport
- Water Supply and Usage
- Waste Management
- Agriculture
- Tourism
- Natural Resources

13.2 OWNERSHIP AND ACCESS

The subject site and area of application is owned by North Cork Co-Operative Creameries Ltd (NCCCL). A small area of the site is leased to another company called Bioatlantis. The main process being undertaken by Bioatlantis on the NCCCL site is described in Chapter 2 Description of the Activity.

The society was established at the end of the 19th century and was known as the Castlecor Dairy Company. In 1928 it purchased the milk interests of the Cleeves Company in the town of Kanturk and the Society was renamed North Cork Co-Operative Creameries Ltd. The central creamery is situated in Strand Street on the banks of the Allow River. Originally the Society had 5 branch creameries, but as part of a rationalisation plan in the late 1970's, four of these were closed. The original building was reconstructed in 1961 and the dairy was equipped with a modern stainless steel plant. The manufacture of casein commenced in 1936 and a new factory for casein production was constructed in 1968.

The site is located on the east side of Strand Street/Bluepool (R579) in Kanturk which is the busiest street. The R579 is a major link to the N72(Mallow/Killarney) road. The site is located on the west side of the River Allow.

There are three entrances into the facility from the R579. Artic trucks can access the site from entrances to the north and to the south of the site. There is an entrance point for staff midway between the points. There is good visibility on approach to the access points as detailed in Chapter 12 Traffic.

13.3 LOCAL SETTLEMENT

The immediate surroundings to the west of the NCCCL facility are retail and residential to the north, and less dense retail to the south. The River Allow is adjacent the entire east boundary of the site. The NCCCL site comprises both an area of built structures (brownfield) at the northern end of the site and pasture land (greenfield) at the southern end.

Further details on the nature of the local settlements and their inhabitants are provided in Chapter 4 Human Beings.

13.4 ELECTRICITY SUPPLY & ENERGY USE

The facility is supplied with mains power. Overall energy used on site is 28,000,000 kWh per annum.

Electricity used on the site for NCCCL is 6,000,000kWh per annum. Electricity used on site by Bioatlantis is 340,243kW/hr per annum.

The amount of oil used on site totals 23,000 T per annum. This figure represents oil use for both NCCCL and Bioatlantis.

NCCCL also use liquefied petroleum gas and annual usage is approximately 487,000L.

13.5 TRANSPORT

Further details regarding the road network around the site are presented in Chapter 12 Traffic.

13.6 WATER SUPPLY AND USAGE

The NCCCL facility utilises 156,000m^3 of water per annum. Water is sourced primarily from two wells which are located on site.

The Bioatlantis operation used 13,506m^3 and 13,999m^3 of water in 2014 and 2015 respectively. This reflects an increase in water use of 3.7% in 2015. This water is sourced from the Kilrush mains supply.

13.7 WASTE MANAGEMENT

All waste generated on site is segregated into hazardous and non-hazardous waste. The typical wastes generated on site include:

- Mixed Municipal Waste
- Milk (Antibiotic)
- Waste oils
- Metals
- Sludge from NCCCL's on-site WWTP
- Sludge from Bioatlantis' production process

The majority of the Mixed Municipal Waste consists of rejected packaging (outer packaging and butter liners for butter, bottle caps and labels for cream) as well as string and crepe tape from bags used in packing dried milk powder.

All waste is removed for recycling, reuse, recovery or disposal by appropriately authorised waste contractors. These are detailed in Table 13.1 below.

Waste description	EWC Code	Source of waste	Quantity generated (tonnes per month)
Mixed Municipal Waste	20 03 01	All Areas	6.07
Milk	02 05 01	Milk, when tested upon arrival to site, does not meet acceptable standards.	1.72
Sludge from WWTP	02 05 02	WWTP	605
Waste Oil	20 01 26	Gear boxes, homogenisers	0.125
Metals	20 01 40	Replaced piping	2.88
Sludge from Bioatlantis activity	02 02 01	Process	138
Fat from Fat Trap @ WWTP	02 05 01	Grease/Fat trap prior to effluent entry to WWTP	1.09

Table 13.1 Waste Generation at the facility

NCCCL have redirected a number of waste types away from landfill by researching alternative options for management of some waste streams generated on site. These are outlined in Table 13.2 below.

Process	Waste Type Generated	Waste Minimisation/Prevention Measure
Spray Dried Milk Powder	Oversized powder granules	Sent off-site for use in Animal Feed (Category 3 Animal By-Product)
Butter Production	Rejected Butter	Sent for recovery within the production process -
CIP system	CIP Packaging	Reduced quantity of drums being received as product packaging. CIP chemicals delivered in IBCs.

Table 13.2 Alternative options for management waste streams generated on site

Sludge from NCCCL's WWTP is landspread on 9 farms in Cork, Limerick and Kerry. Each farm has a nutrient management plan (NMP) which has been prepared by SEDE Ireland. Nutrient management plans are included as Appendix E.4 of the IED licence for which this EIS has been prepared. Sludge from the dairy process is generated throughout the year but in greater volume during the summer months, reflecting the greater quantity of milk produced during that period. Sludge is sent off-site for storage to Galvin's Farm in Banogue, County Limerick when required.

Sludge from Bioatlantis' process is landspread on one farm in Co. Limerick.

Mixed municipal waste is collected by Munster Waste Management where it is sent for baling and on to landfill.

Antibiotic milk waste is collected from site by Enva. It is transported to Clearpower Antibiotics (Enva) in Ballybrittas Co. Laois where it is temporarily stored in tanks and is then spread on cereal ground and ploughed down before crop sowing commences. Waste oils are collected by Enva for refining/reuse within Ireland.

Waste metals are collected by Cork Metals for export abroad for recycling. Fat from the grease trap prior to the WWTP is sent to Munster Proteins for reprocessing.

13.8 AGRICULTURE

The facility is located within a largely agricultural area. Kanturk is a central hub for the surrounding agricultural industry. A high percentage of heavy goods would be agricultural, including livestock, feed and plant machinery. Additionally, Kanturk Co-Op Mart operates weekly on Tuesdays from which large volumes of livestock traffic are generated, because of the vast surrounding agricultural community.

13.9 TOURISM

The majority of Kanturk town centre has been designated an Architectural Conservation Area given the number of traditionally designed buildings. There are 32 buildings or other structures entered in the Record of Protected Structures. Kanturk Bridge is one of the most attractive features of the town and still bears the inscription by the 14th century poet, Godfraidh Fionn O' Dalaigh. Kanturk castle to the south of the town is also an important feature and its setting should be protected. Kanturk is surrounded by numerous archaeological features.

The Allow, Dalua and Brogeen rivers are considered as part of the Blackwater Valley Special Area of Conservation. These rivers flow into the Blackwater which is an important habitat for numerous protected species including the Freshwater Pearl Mussel. The Kanturk Electoral Area Local Area Plan states that all future development needs to avoid adverse impacts on these sites. Tourism is discussed under Chapter 5 Human Beings.

13.10 NATURAL RESOURCES

Power and water usage represent the main consumption of natural resources, however energy and water saving measures will be implemented as much as practicable. Bioatlantis' activities which take place on site includes the receipt, washing, chopping and drying of seaweed, followed by the extraction of seaweed nutrients. Bioatlantis utilise 1,054 tonnes of seaweed per annum.

Any wastes generated will be disposed of safely and recovered and recycled where possible. See Section 13.7 Waste Management.

13.11 REMEDIAL AND MITIGATION MEASURES

With the site location in existence as a creamery for over 85 years it is considered that it has had, is having and will have little if any negative impact on the economic assets of the area while in operation. In terms of the employment generated by the site it has a slight positive impact. Potential mitigation measures relating to each of the material assets described above are presented within the individual specialist chapters of this EIS.

There is no requirement for remedial measures to be carried out in relation to material assets described above.

14.0 INTERACTIONS

14.1 INTRODUCTION

As a requirement of the European Communities (Environmental Impact Assessment) Regulations, 1999 (S.I. No. 93 of 1999), and best practice guidelines and advice notes, not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the inter-relationships between these factors be identified and assessed.

This section of the assessment was carried out by AWN Consulting Ltd.

Part II (2nd Schedule) of the Regulations requires that the interactions between human beings, flora and fauna, soil, water, air and climatic factors, landscape, material assets and architectural, archaeological and cultural heritage, be assessed. In the interest of completeness, the interactions between these elements and noise have also been considered.

The aspects of the environment likely to be significantly affected by the current NCCCL facility have been considered in detail in the relevant Chapters of the EIS. In order to demonstrate the areas in which significant interactions occur and to grade these interactions, a matrix has been prepared; this is presented as Table 14.1.

Where any environmental element in the top row of the matrix (the receptor) is likely to be affected in any way by any element in the left-most column (the impactor), which contains the list of aspects of the environment likely to be significantly affected by the proposed development, the impact is described at the relevant intersection point on the matrix.

As demonstrated by the matrix, most inter-relationships are neutral in impact.

14.2 DISCUSSION – POSITIVE IMPACTS

Material Assets on:

Human Beings

The development facilitates the continuation of employment at the facility. This is likely to be a long term positive impact.

14.3 DISCUSSION – NEUTRAL IMPACTS

The reasoning behind the interactions which are given a neutral rating is as follows.

Water on:

Human Beings

The activity generates surface water and effluent emissions (run off) to the River Allow. In the event of an uncontrolled discharge, there is the potential for impact on human beings using this amenity. It is concluded that the range of mitigation measures including management of surface water run-off and operating in

compliance with the waste water licence will ensure the impact is long term and neutral.

Flora and Fauna

The development results in discharges to the River Allow which is part of the Blackwater SAC. Any accidental discharges or discharges above licence concentrations could impact on flora and fauna within the River. It is concluded that the range of mitigation measures including management of surface water run-off and operating in compliance with the waste water licence will ensure the impact is long term and neutral.

Soil and Geology

Surface water runoff within potentially contaminated areas are collecting in sumps and will be treated within the WWTP. The site is mostly capped and there is no direct discharge to ground, thereby ensuring a short term and neutral impact.

Material assets on:

Human Beings

The development has a limited impact on material assets relating to human beings. The activity generates commuter traffic and the existing road network has sufficient capacity to service the development. The impact is therefore neutral and long term.

Landscape on:

Human Beings

This is an existing site and while the impact the current site has on the landscape is slightly negative, as there is no building or development proposed within the licence application for which this EIS has been prepared, it will have no additional impact on the landscape. Therefore the existing site is deemed to have an overall long-term neutral impact on the landscape and visual characteristics of the area.

14.4 DISCUSSION – NEGATIVE IMPACTS

Air and noise on:

Human Beings

The use of heavy fuel oil may result in possible breaches of air quality standards. There is a plan to move to replace heavy fuel use with LPG to remove this negative impact.

Noise monitoring has shown that the noise emissions from the plant do not currently meet compliance with standard EPA noise criteria. Noise mitigation measures are planned to meet this criteria at the creamery.

14.5 SUMMARY

In summary, the interactions between the environmental factors and impacts discussed in this EIS have been assessed and the majority of interactions are long-term and neutral

Figure 14.1 Summary of Significant Interactions

Receptor / Impactor	Human Beings	Flora & Fauna	Soil & Geology	Water	Air & Climate	Landscape	Noise	Material Assets	Archaeology
Human Beings		NA	NA	N	Sl N	NA	Sl N	NA	NA
Flora & Fauna	NA		NA	NA	NA	NA	NA	NA	NA
Soil & Geology	NA	NA		N	NA	NA	NA	NA	NA
Water	N	N	N		NA	NA	NA	NA	NA
Air & Climate	N	NA	NA	N		NA	NA	NA	NA
Landscape	N	NA	NA	NA	NA		NA	NA	NA
Noise	Sl N	NA	NA	NA	NA	NA		NA	NA
Material Assets	P	NA	NA	NA	NA	NA	NA		NA
Archaeology	NA	NA	NA	NA	NA	NA	NA	NA	

N= Neutral
Sl N= Slight Negative
Sl P= Slight Positive
P= Positive
NA= No Interaction/Not Applicable