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12 Air Quality and Dust

12.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) assesses the air quality and dust impact of the Ballyhale Flood Relief Scheme, Ballyhale, Co. Kilkenny during the Construction and Operational Phases.

This Air Quality and Dust Impact Assessment has been prepared by Olivia Maguire, a senior consultant with AONA Environmental Consulting Ltd. Olivia's areas of professional expertise are in Air Quality & Odour impact assessment and mitigation design as well as Health & Safety consultancy. Olivia is a Member of Institute of Environmental Management & Assessment and a Member of Occupational Hygiene Society of Ireland with a B.Sc. Occupational Safety and Health, M.Sc. Environmental Science, B.Sc. (Hons) Geography, and is a qualified ISO 14001: Lead Environmental Auditor. Olivia has in excess of 15 years of professional expertise in environmental consultancy.

This Air Quality and Dust Impact Assessment has been reviewed by Mervyn Keegan of AONA Environmental Consulting Ltd. Mervyn Keegan is a Director of the environmental consultancy, AONA Environmental Consulting Ltd. Mervyn Keegan's areas of professional expertise are in Noise Control & Acoustics and Air Quality & Odour consultancy, including impact assessment and mitigation design. Mervyn Keegan has 23 years of environmental consultancy experience. Mervyn is a member of the Institute of Acoustics, a member of the Institute of Environmental Sciences and a member of the Institute of Air Quality Management with a Bachelor of Science Degree (Applied Sciences), a Master of Science Degree (Environmental Science) and a Diploma in Acoustics in Noise Control. AONA Environmental Consulting Ltd. is an independent consultancy specialising in Environmental Impact Assessment and Licensing. Mervyn Keegan has prepared in excess of fifty Noise & Vibration and Air Quality & Climate impact assessments annually for infrastructure and quarry developments in the Republic of Ireland, Northern Ireland and the UK in the last 20 years and is an expert in the awareness and understanding of the relevant legislation and guidance that pertains to best practise in such assessments. Mervyn Keegan has appeared as an Expert Witness at oral hearings, public inquiries and legal hearings. Mervyn Keegan has produced Noise, Air Quality & Odour Impact Assessment reports to assess the impacts of a range of development types including

roads, residential developments, industrial developments, quarries and mines and wind energy developments among others.

12.2 Assessment Methodology

12.2.1 Dust Deposition Guidelines

Dust particles can be classified into those that are easily deposited and those that remain suspended in the air for long periods. This division is useful as deposited dust is usually the coarse fraction of particulates that causes dust annoyance, whereas suspended particulate matter is implicated more in exposure impacts. Airborne particles have a large range of diameters, from nano-particles and ultrafine particles (diameters less than 0.1µm) to the very large particles with diameters up towards 100µm. There is no clear dividing line between the sizes of suspended particulates and deposited particulates, although particles with diameters >50 µm tend to be deposited quickly and particles of diameter <10 µm (PM_{10}) have an extremely low deposition rate in comparison. Therefore, the size of suspended and deposited dust particles affects their distribution and as such requires two very different approaches to sampling these fractions. PM_{10} is the fraction of airborne (suspended) particulates which contains particles of diameter less than 10µm. $PM_{2.5}$ is the fraction of airborne (suspended) particulates which contains particles of diameter less than 2.5µm. PM_{10} and $PM_{2.5}$ particles can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. Total Suspended Particles (TSP) is the term used when referring to larger particles which do not have a specified size limit. It is common for TSP to be measured alongside PM_{10} and $PM_{2.5}$ particularly at industrial sites when dust monitoring is undertaken.

Particulate matter can emanate from natural and anthropogenic sources. Natural sources include sea salt, forest fires, pollen and moulds. Natural sources are unregulated and harder to control. Anthropogenic sources can be regulated and understanding the sources of particulate matter is very important. PM_{10} is most commonly associated with road dust and construction activities. Wear and tear of brakes and tyres on vehicles and crushing activities at construction sites can all contribute to a rise in PM_{10}. $PM_{2.5}$ is associated with fuel burning, industrial combustion processes and vehicle emissions. Larger particles (100µm diameter) are likely to settle within 5-10m of their source under a typical mean wind speed of 4-5 m/s, and particles between 30-100 µm diameter are likely to settle within 100m of the source. Smaller particles, particularly those <10 µm in diameter, i.e. PM_{10}, have a greater potential to

have their settling rate impeded by atmospheric turbulence and to be transported further from their source. Dust emissions are exacerbated by dry weather and high wind speeds. The impact of dust therefore, also depends on the wind direction and the relative location of the dust source and receiver.

Currently no Irish statutory standards or limits exist for the assessment of dust deposition and its tendency for causing nuisance. Similarly, no official air quality criterion has been set at a European or World Health Organisation (WHO) level, although a range of national 'yardstick' criteria from other countries is found in literature.

The Quarries and Ancillary Activities, Guidelines for Planning Authorities states that following with regard to the control of dust;

"There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert mineral/aggregate dust. (See, however, the Air Quality Standards Regulations 2011 for measurement standards). There are a number of methods to measure dust deposition (such as the Frisbee method) but only the German TA Luft Air Quality Standard relates a specific method (i.e. Bergerhoff) of measuring dust deposition with dust nuisance. On this basis it is recommended that the following TA Luft dust deposition limit value be adopted at site boundaries near quarry developments:

Total dust deposition (soluble and insoluble): 350 milligram per square metre per day (when averaged over a 30-day period).

Best practice dust control measures should be proposed by the applicant".

In England and Wales, a *'custom and practice'* limit of 200 mg/m^2/day is sometimes referenced using Frisbee-type Deposition Gauges. This value was derived by multiplying a historical, typical UK median background by 3.5 (which was the ratio of the 95th percentile to the median). It should be noted that because background dust levels can vary significantly from place to place and with season, the authors Vallack & Shillito were clear that the preferred approach is to calculate a bespoke site-specific "complaints likely" dust guideline, where sufficient local baseline monitoring data is available (at least 12-months) based on 3.5 times the median background level. However, such bespoke local baseline data is often not available and in such cases the authors recommended using as a fall-back the 95th percentile of typical UK background data. It is important that the limitations of the 200 mg/m^2/day benchmark are appreciated: firstly, it is simply a custom and practice yardstick and it was never based on actual dose-response data; secondly, in deriving this default "complaints likely"

guideline, the authors used a dataset that was quite old and not necessarily indicative of today's background levels.

The German TA Luft Regulations, "Technical Instructions on Air Quality Control" state that total dust deposition (soluble and insoluble, measured using Bergerhoff type dust deposit gauges as per German Standard Method for determination of dust deposition rate, VDI 2119) should not exceed a dust deposition rate of 350 mg/m^2/day (when averaged over a 30+/-2 day period). The use of this limit value is appropriate to minimise the impact of airborne dust levels on the receiving environment beyond the site boundary. The German TA Luft criteria for '*possible nuisance'* and *'very likely nuisance'* are 350 mg/m^2/day and 650 mg/m^2/day, respectively.

Criteria from other countries that can be referred to include;

- In the USA, Washington has set a state standard of 187 mg/m^2/day for residential areas.
- Western Australia also sets a two-stage standard, with '*loss of amenity first perceived'* at 133 mg/m^2/day and '*unacceptable reduction in air quality*' at 333 mg/m^2/day.
- The Swedish limits promoted by the Stockholm Environment Institute, and used regularly in Scotland, range from 140 mg/m^2/day for rural areas to 260 mg/m^2/day for town centres.

These go some way to addressing the view that the annoyance impact (and hence potential for complaints) depends on the worsening of dust levels above existing background levels.

In 2005, the UK Highways Agency released an Interim Advice Note 61/05 '*Guidance for Undertaking Environmental Assessment of Air Quality for Sensitive Ecosystems in Internationally Designated Nature Conservation Sites and SSSIs*' as a supplement to the Design Manual for Roads and Bridges (DMRB) Guidelines. This interim guidance states that dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 1,000 mg/m^2/day which is considerably greater than the level at which most dust deposition may start to cause a perceptible nuisance to humans. As such, once dust deposition rates are maintained within the guidelines for human nuisance the impact of dust deposition on sensitive ecosystems is considered negligible. Therefore, the following dust deposition limits are typically recommended;

- Dust Deposition Rate limit = 350 mg/m^2/day (averaged over a 30+/-2 day period using Bergerhoff Gauge Method).
- Dust Deposition Rate limit affecting sensitive ecological receivers = 1,000 mg/m^2/day
- PM_{10} 24 Hour Mean concentration limit = 50 µg/m^3 not to be exceeded more than 35 times a calendar year
- PM_{10} Annual Mean concentration limit = 40 µg/m^3
- $PM_{2.5}$ Annual Mean concentration limit = 25 µg/m^3

12.2.2 Guidance on the assessment of dust from demolition and construction

As prescribed within Environmental Protection UK and the Institute of Air Quality Management, Land-use Planning & Development Control: Planning For Air Quality (January 2017) the proposed Ballyhale Flood Relief Scheme has been assessed in accordance to the "Guidance on the assessment of dust from demolition and construction" (Version 1.1), published by The Institute of Air Quality Management in February 2014. This guidance has been referenced to assess the potential impact of the vehicle movements and the earthworks phase of the proposed works. Good practice construction mitigation measures are recommended to be implemented to minimise emission quantities during construction.

12.3 Existing Environment

12.3.1 Baseline Air Quality

No baseline air quality or dust deposition survey has been undertaken. Reference has been made to EPA data to quantify the existing air quality in proximity to the proposed development site.

The EPA has divided the country into zones for the assessment and management of air quality. The zones adopted in Ireland are Zone A, the Dublin conurbation; Zone B, the Cork conurbation; Zone C, comprising 21 large towns in Ireland with a population >15,000; and Zone D, the remaining area of Ireland. The background air quality in the area of the development is of good quality and the site is located in 'Zone D' as denoted by the EPA.

Nitrogen Dioxide (NO_2), Ozone and Particulate Matter (PM_{10}) background concentrations from the Seville lodge, Callan Road, Kilkenny EPA Air Quality monitoring station which is approximately 20km north-north-west of Ballyhale have been referenced to 15/10/2021.

The CAFE (Clean Air for Europe) Directive sets air quality standards for member states in Europe and has been transposed into Irish legislation by the Air Quality Standards Regulations 2011. Table 1-1 shows the most recent full year of data in 2021. Results show that there were no exceedances of these EU CAFÉ directive annual mean limits for NO_2, Ozone or PM_{10} in 2021.

Table 12-1: Seville lodge, Callan Road, Kilkenny EPA Air Quality monitoring station data 2021

Month	**NO_2 (µg /m^3)**	**Ozone (µg /m^3)**	**PM_{10} (µg /m^3)**
January	7.39	43.37	18.34
February	3.99	59.07	25.67
March	4.27	56.19	22.55
April	5.13	65.23	20.36
May	2.97	63.52	14.64
June	3.02	50.02	15.45
July	3.53	47.04	13.88
August	3.09	49.25	13.91
September	3.81	51.68	15.35
October	3.30	52.33	11.43
November	4.52	47.97	14.63
December	5.68	44.45	17.20
Annual Mean (2021)	4.22	52.56	16.97
EU CAFÉ Directive Limit	40 µg/m^3	None specified	40 µg/m^3

The Environmental Protection Agency's Air Quality Index for Health (AQIH) is a number from one to 10 that identifies the current air quality currently in a region and whether or not this might affect human health. A reading of 10 means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The AQIH readings are based on five air pollutants which can harm human health: Ozone gas,

nitrogen dioxide gas, sulphur dioxide gas, $PM_{2.5}$ particles and PM_{10} particles. The AQIH at Seville lodge, Callan Road, Kilkenny is currently 2 - Good [index calculated at 15.37pm, Wednesday, August 24th, 2022] (EPA, 2022).

The World Health Organization (WHO) guidelines on outdoor (ambient) air pollution levels, which are widely used as reference tools by policymakers across the world to set standards and goals for air quality management, were recently updated in September 2021. Across nearly all pollutants, the new recommended limits for concentrations and exposures are lower than the previous guidelines. The 2021 update reflects far-reaching evidence that shows how air pollution affects many aspects of health, even at low levels.

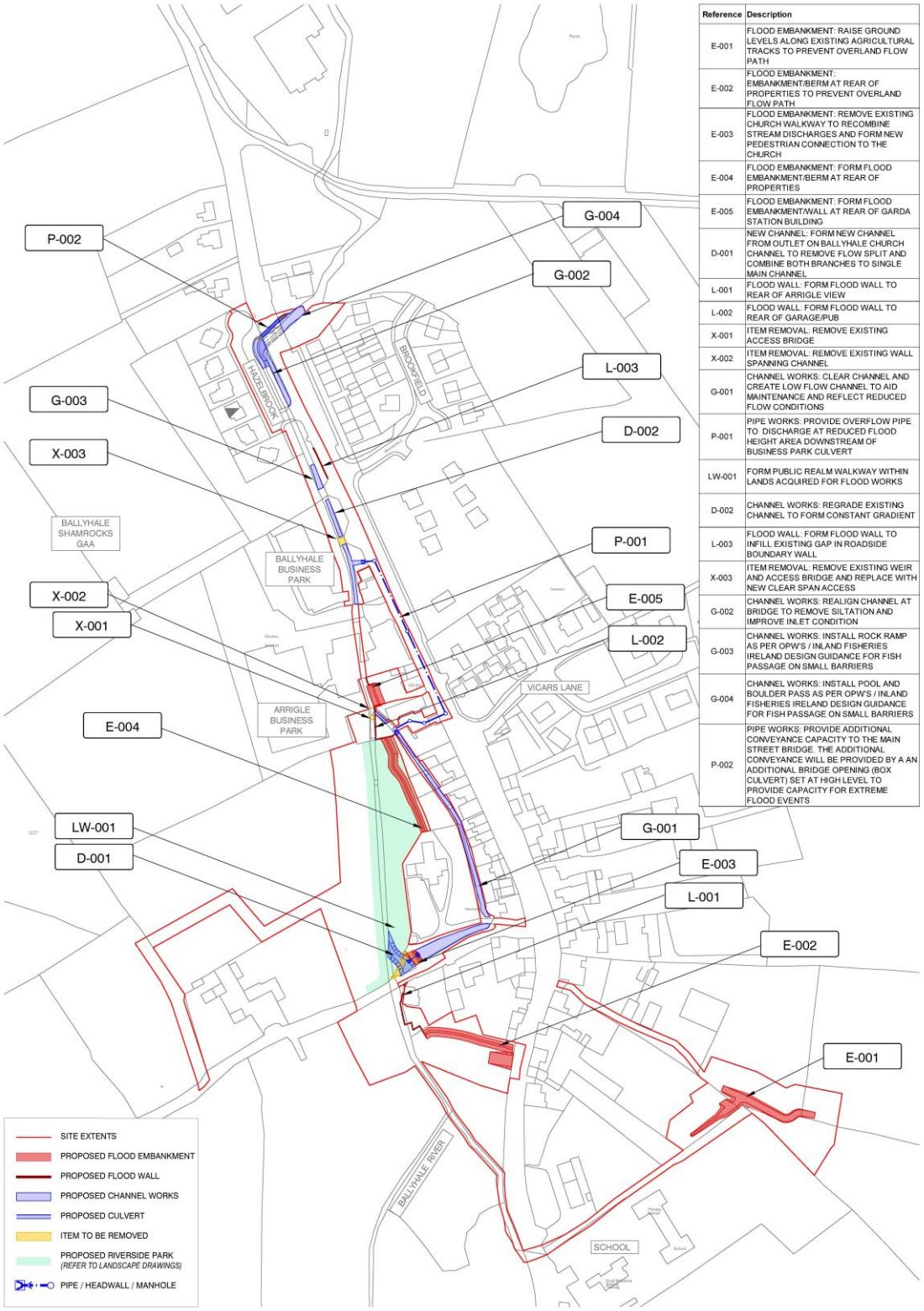
12.4 Characteristics of the Proposed Development

Description of Proposed Construction Works:

The proposed works consist of a range of interventions along the watercourse reach. The general intent of the works are to enhance the flow capacity and level of defence through the town so that the design flows can be conveyed through the town without causing property flooding. Proposed works as shown in Figure 12-1 incorporate:

- Embankments located upstream of the village to prevent overland flooding
- Flood wall to western perimeter of “Arrigle View”
- A section of new river channel re-connecting all outlets from the Chapel Lane bridge into the western river channel and removing the flow split. This will require excavation of the existing church pedestrian access and replacement via a new pedestrian connection which also serves to form a new bank to the redirected stream.
- Landscaping of eastern river channel to allow for a low flow channel to reflect reduced flow conditions
- Flood Defences (wall and embankments) between the western channel and the properties at risk on Main St. Lands acquired for these flood defences will be landscaped to provide a riverside walkway/park
- Removal of one of two existing minor private bridges providing access across the river to a private land parcel. Access to the parcel will be maintained by retrofitting the second bridge to flood defence level
- Removal of a boundary wall spanning the watercourse
- Removal of the existing weir at the Ballyhale Business Park access and regrading of channel to improve channel capacity

- Low flood wall alongside the road opposite Brookfield to prevent out of bank flows emerging onto the road surface.
- Provision of rock ramp to existing weir at Ballyhale Shamrocks access to improve fish pass conditions
- Channel reprofiling at the existing Main St bridge to improve bridge inlet conditions.
- Provision of additional conveyance capacity to the Main Street Bridge. The additional conveyance will be provided by an additional bridge opening (box culvert) set at high level to provide capacity for extreme flood events.
- Provision of rock ramp to downstream face of the Main Street Bridge to improve fish pass conditions
- Provision of a temporary construction compound.
- Fencing, accommodation works and all site development and landscaping works.



Reference	Description
E-001	FLOOD EMBANKMENT: RAISE GROUND LEVELS ALONG EXISTING AGRICULTURAL TRACKS TO PREVENT OVERLAND FLOW PATH
E-002	FLOOD EMBANKMENT: EMBANKMENT/BERM AT REAR OF PROPERTIES TO PREVENT OVERLAND FLOW PATH
E-003	FLOOD EMBANKMENT: REMOVE EXISTING CHURCH WALKWAY TO RECOMBINE STREAM DISCHARGES AND FORM NEW PEDESTRIAN CONNECTION TO THE CHURCH
E-004	FLOOD EMBANKMENT: FORM FLOOD EMBANKMENT/BERM AT REAR OF PROPERTIES
E-005	FLOOD EMBANKMENT: FORM FLOOD EMBANKMENT/WALL AT REAR OF GARDA STATION BUILDING
D-001	NEW CHANNEL: FORM NEW CHANNEL FROM OUTLET ON BALLYHALE CHURCH CHANNEL TO REMOVE FLOW SPLIT AND COMBINE BOTH BRANCHES TO SINGLE MAIN CHANNEL
L-001	FLOOD WALL: FORM FLOOD WALL TO REAR OF ARRIGLE VIEW
L-002	FLOOD WALL: FORM FLOOD WALL TO REAR OF GARAGE/PUB
X-001	ITEM REMOVAL: REMOVE EXISTING ACCESS BRIDGE
X-002	ITEM REMOVAL: REMOVE EXISTING WALL SPANNING CHANNEL
G-001	CHANNEL WORKS: CLEAR CHANNEL AND CREATE LOW FLOW CHANNEL TO AID MAINTENANCE AND REFLECT REDUCED FLOW CONDITIONS
P-001	PIPE WORKS: PROVIDE OVERFLOW PIPE TO DISCHARGE AT REDUCED FLOOD HEIGHT AREA DOWNSTREAM OF BUSINESS PARK CULVERT
LW-001	FORM PUBLIC REALM WALKWAY WITHIN LANDS ACQUIRED FOR FLOOD WORKS
D-002	CHANNEL WORKS: REGRADE EXISTING CHANNEL TO FORM CONSTANT GRADIENT
L-003	FLOOD WALL: FORM FLOOD WALL TO INFILL EXISTING GAP IN ROADSIDE BOUNDARY WALL
X-003	ITEM REMOVAL: REMOVE EXISTING WEIR AND ACCESS BRIDGE AND REPLACE WITH NEW CLEAR SPAN ACCESS
G-002	CHANNEL WORKS: REALIGN CHANNEL AT BRIDGE TO REMOVE SILTATION AND IMPROVE INLET CONDITION
G-003	CHANNEL WORKS: INSTALL ROCK RAMP AS PER OPW'S / INLAND FISHERIES IRELAND DESIGN GUIDANCE FOR FISH PASSAGE ON SMALL BARRIERS
G-004	CHANNEL WORKS: INSTALL POOL AND BOULDER PASS AS PER OPW'S / INLAND FISHERIES IRELAND DESIGN GUIDANCE FOR FISH PASSAGE ON SMALL BARRIERS
P-002	PIPE WORKS: PROVIDE ADDITIONAL CONVEYANCE CAPACITY TO THE MAIN STREET BRIDGE. THE ADDITIONAL CONVEYANCE WILL BE PROVIDED BY A AN ADDITIONAL BRIDGE OPENING (BOX CULVERT) SET AT HIGH LEVEL TO PROVIDE CAPACITY FOR EXTREME FLOOD EVENTS

Figure 12.1: Schematic Works Layout

The primary works elements are anticipated to include:

- Site Setup: The contractor shall establish a site compound and additional temporary compounds as necessary. Given the nature of the proposed works

at Ballyhale there are a number of discrete works areas, and it is likely that individual access will be required to each area, complete with temporary fencing around these works areas as required. Much of the site is adjacent or within the Ballyhale River which is a sensitive receptor draining to an SAC.

- Site Clearance and Demolition: The works area will be required to be cleared of vegetation. The contractor shall minimise the vegetation clearance carried out and only clear what is strictly necessary to facilitate the works. Minor demolition is proposed including replacement of existing walls and existing channel structures. All demolition waste will be removed off-site to a licensed facility.
- Earthworks: Excavated material will be generated from the stripping of surface and excavation of subsoil layers for the construction of the proposed foundations and channel works. Earthworks material will also be placed to form embankments.
- Installation of Drainage: The proposed works include a new relief drainage line down Ballyhale Main Street. This will involve construction within the existing road carriageway.
- New Structures: Several relatively minor flood walls and structures are proposed. Foundations for these structures are anticipated to involve reasonably shallow excavations.
- Landscaping & Demobilisation: On completion of the main flood relief works all disturbed areas shall be fully reinstated and permanent landscaping works shall be installed in accordance with landscape plans for the project. All temporary fencing and temporary site compounds shall be removed and lands fully reinstated.

12.5 Predicted Impacts of the Proposed Development

12.5.1 Do Nothing Scenario

The ‘Do Nothing’ scenario is defined as the option involving no future expenditure on flood defences or maintenance of existing defences/channels. There is no air quality and dust impact from the ‘Do Nothing scenario’.

12.5.2 Construction Stage

Construction Dust Impact Assessment:

STEP 1: Screening the Need for a Detailed Assessment

An assessment will normally be required where there is:

- a 'human receptor' within:
    - 350 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)
- an 'ecological receptor' within:
    - 50 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)

STEP 2: Assess the Risk of Dust Impacts

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (STEP 2A); and
- the sensitivity of the area to dust impacts (STEP 2B), which is defined as low, medium or high sensitivity.

These two factors are combined in STEP 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time. Where appropriate, the site can be divided into 'zones' for the dust risk assessment.

Step 2A: Define the Potential Dust Emission Magnitude

Earthworks, construction and trackout will occur during the construction phase. Table 12.2 describes the potential dust emission class criteria for each outlined construction activity.

Table 12-2: Criteria Used in the Determination of Dust Emission Class

Activity	**Criteria used to Determine Dust Emission Class**		
	Small	**Medium**	**Large**
Demolition	• Total building volume <20,000 m^3	• Total building volume 20,000 m^3 - 50,000m^3	• Total building volume >50,000m^3

	• Construction material with low potential for dust release (e.g. metal cladding or timber • Demolition activities <10 m above ground level • Demolition during wetter months	• Potentially dusty construction material. • Demolition activities 10-20 m above ground level	• Potentially dusty construction material (e.g. concrete) • On-site crushing and screening, • Demolition activities >20 m above ground level
Earthworks	• Total site area <2,500m^2 • soil type with large grain size (e.g. sand), • <5 heavy moving earth vehicles active at any one time • formation of bunds <4 m in height • Total material moved <20,000 tonnes	• Total site area 2,500 – 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5-10 heavy moving earth moving vehicles active at any one time. • formation of bunds 4 m - 8 m in height, • Total material moved 20,000 – 100,000 tonnes.	• Total site area >10,000m^2 • potentially dusty soil type (e.g. clay) • >10 heavy earth moving vehicles active at any one time. • formation of bunds >8 m in height • Total material moved >100,000 tonnes
Construction	• Total building volume <25,000m^3 • Construction material with low potential for dust release	• Total building volume 25,000 – 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On-site concrete batching	• Total building volume >100,000m^3 • On-site concrete batching • Sandblasting
Trackout	• <10 outward HDV trips in any one day • surface material with low potential for dust release, • Unpaved road length <50m	• 10 - 50 outward HDV trips in any one day • moderately dusty surface material (e.g. high clay content), • Unpaved road length 50-100m	• >50 outward HDV trips in any one day • potentially dusty surface material (e.g. high clay content • Unpaved road length >100m

The potential dust emission magnitudes for the proposed development were estimated using information provided and determined using the criteria detailed in Table 1-2 as follows;

Demolition:

Demolition includes any activity involved with the removal of an existing structure (or structures). Minor demolition is proposed including replacement of existing walls and existing channel structures., incorporating the following:

- Flood Wall to rear of Arrigle View (L-001) - Remove portions of existing boundary wall to create space for foundation and new wall (length 28m)
- Flood Wall to rear of Garage/Pub (L-002) - Remove top of existing boundary wall to create space for foundation and new wall (length 24m)
- Flood Wall adjacent to Hazelbrook (L-003) - Remove existing elements of wall along route and excavate down to foundation level (length 33m)
- X-001 – Remove existing access bridge (length 4m)
- X-002 – Remove existing wall spanning channel (length 5m)
- X-003 – Remove existing weir to new design profile (length 8m)
- Total building volume <20,000 m^3
- Demolition activities <10 m above ground level
- Therefore, the dust emission magnitude for Demolition is defined as **Small.**

Earthworks:

Earthworks covers the processes of soil-stripping, ground-levelling, excavation, and landscaping. Excavated material will be generated from the stripping of surface and excavation of subsoil layers for the construction of the proposed foundations and channel works. Earthwork's material will be placed to form embankments. Excess material will be disposed offsite.

- The volume of excavated material is estimated to be approx. 1,800 m^3 export and 2,100 m^3 import. Therefore, <1400 tonnes
- Total site area of works <2,500m^2
- The site itself contains potentially dusty soil types. Site investigations revealed topsoil (with a little fill in places) overlying a firm to stiff very gravelly clay.
- It is assumed that there will be approx. 4 heavy moving earth moving vehicles active at any one time during busiest period of works
- Therefore, the dust emission magnitude for Earthworks is defined as **Small**.

Construction:

Construction covers any activity involved with the provision of a new structure (or structures), its modification or refurbishment. Works include:

- Flood Embankment Works (E-001, E-002, E-004, E-005) - Construct the embankment to the designated height.

- Remove existing church walkway to recombine stream discharges and form new pedestrian connection to the church (E-003)
- New Channel (D-001) – Form new channel from outlet on Ballyhale Church Channel to remove flow split and combine both branches to single main channel.
- Flood Wall to western perimeter of Arrigle View (L-001) - Cast an in-situ reinforced concrete foundation along the length of the boundary wall and construct wall to proposed heights along defence line.
- Flood Wall to the Back of Andy's Pub (L-002) - Cast an in-situ reinforced concrete foundation along the length of the boundary wall and construct wall to proposed height.
- Piped Route (P-001) - Install pipe.
- Install box culvert at main street bridge (P-002)
- Weir Removal, underpin existing bridge as required (X-003)
- In-Channel Works (G-001, D-001, D-002, G-002, G-003, G-004, PR-002)- Complete in channel works including shaping of channels, installation of rock ramps and pool and boulder pass, placement of any geotextiles and formation of new channel bed and banks.
- LW-001 – Form public realm walkway
- Total building volume <25,000m^3
- Concrete batching will take place off site.
- Potentially dusty construction material (e.g. concrete) but in small quantities.
- Therefore, the dust emission magnitude for Construction is defined as **Small.**

Trackout:

Trackout covers the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

- For this scale of development, it is not expected that HGV vehicle movements will exceed 4 vehicles per hour during the busiest period of construction works. HGVs are anticipated to be more numerous during the excavation stage where waste and soil is removed from site and when bringing bulk construction materials to site. Therefore, it is anticipated that there will be a maximum of 10 - 50 outward HDV trips in any one day.
- Moderately dusty surface material (e.g. high clay content)
- Unpaved road length, some elements are >100m
- Therefore, the dust emission magnitude for Trackout is defined as **Large**

Step 2B: Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The criteria for determining the sensitivity of receptors is detailed in Table 12-3 for dust soiling effects and health effects of PM_{10}.

Table 12-3: Criteria for Determining Sensitivity of Receivers

Sensitivity of Receiver	**Criteria for Determining Sensitivity**	
	Dust Soiling Effects	**Health Effects of PM_{10}**
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms	Residential properties, hospitals, schools and residential care homes
Medium	Parks, places of work	Office and shop workers not occupationally exposed to PM_{10}
Low	Playing fields, farmland, footpaths, short-term car parks and roads	Public footpaths, playing fields, parks and shopping streets

The criteria detailed in Table 12-4 and Table 12-5 were used to determine the sensitivity of the area to dust soiling effects and human health impacts.

Table 12-4: Sensitivity of the Area to Dust Soiling Effects on People and Property.

Receiver Sensitivity	Number of Receivers	Distance from Source (m)			
		<20m	<50m	<100m	<350m
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 12-5: Sensitivity of the Area to Human Health Impacts.

Receiver Sensitivity	Annual Mean PM_{10} Conc	Number of Receivers	Distance from Source (m)				
			<20m	<50m	<100m	<200m	<350m
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table 12-6: Sensitivity of the Area to Ecological Impacts.

Receiver Sensitivity	**Distance from Source (m)**	
	<20	**<50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Sensitivity of Receivers

A population of 174 was reported in the Census of Ireland 2016, with the population density of the study area recorded as 990.5 persons per square kilometre. Table 12-7 outlines the range of numbers of properties within specific distance bands from the proposed construction activities to determine the receptor sensitivity of the area to Dust Soiling Effects on People and Property.

Table 12-7: Cumulative number of sensitive receivers within 20m, 50m, 100m, 200m and 350m of the site.

Parameter	**Number of Receivers within Distance from Site (m)**				
	<20m	**<50m**	**<100m**	**<200m**	**<350m**
No. of receivers in proximity to Site	~23	~49	~70	>100	>100
Receiver Sensitivity	High	Medium	Low	Low	Low

Sensitivity of People to Dust Soiling

- Demolition, Earthworks and Construction: There is approx. 23 sensitive residential properties within 20m of the proposed construction activities on the site, including the church. There are approx. an additional 26 sensitive residential properties within 50m of the site. Therefore, the sensitivity of the Area to Dust Soiling Effects on People and Property is **High**; in terms of potential earthworks and construction dust impacts.
- Trackout: As general guidance, without site-specific mitigation, trackout may occur from roads up to 500 m from large sites (as determined in Step 2A). As shown in Table 12-7, there are >100 sensitive receptors within 500 m of the site, therefore

Table 12-4 indicates the sensitivity of the area is **Low**; in terms of potential trackout dust impacts.

Sensitivity of the Area to Human Health Impacts

Section 1.3.1 outlines baseline air quality in the study area. The PM_{10} concentrations recorded at Seville lodge, Callan Road, Kilkenny EPA Air quality monitoring station for the calendar year of 2021 are well below the Air Quality Standard annual limit value of 40µg/m^3. It is worthy of note that the annual mean PM_{10} concentrations are above the recent 2021 WHO air quality guideline value of 15 µg/m^3. As shown in Table 12-5, the sensitivity of the Area to Human Health Impacts is **Low**; in terms of potential demolition, earthworks, construction and trackout dust impacts.

Sensitivity of the Area to Ecological Impacts

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

The River Barrow and River Nore SAC designated area is located to the north of Ballyhale as shown in Figure 12-2. This SAC is designated for numerous qualifying interests. The red line boundary of the scheme lies for a very small section within the SAC boundary. The closest works proposed are fish passage works which are approximately 17m from the SAC boundary as shown in Figure 12-1 above. Approximately 28m from the SAC boundary the installation of a box culvert at main street bridge (P-002) is proposed.

Table 12-6 outlines Sensitivity of the Area to Ecological Impacts. A high receiver sensitivity is those receivers with an international or national designation, therefore, the sensitivity of the Area to Ecological Impacts is **High**; in terms of potential demolition, earthworks, construction and track out dust impacts.

Figure 12.2: River Barrow and River Nore SAC Boundary

The sensitivity of the area to dust soiling, human health impacts and ecological impacts for each activity is summarised in Table 12-8.

Table 12-8: Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	Low
Human Health	Low	Low	Low	Low
Ecological Impacts	High	High	High	High

Step 2C: Define the Risk of Impacts

In accordance with the IAQM Guidance, the dust emission magnitude (Step 2A) and sensitivity of the area (Step 2B) have been combined and the risk of impacts from demolition, construction, earthworks and trackout determined (before mitigation is applied). The risk of dust soiling, impact on human health and ecological impact before mitigation, is summarised in Table 12-9.

Table 12-9: Summary Dust Risk to Define Site-specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Low Risk	Low Risk	Low Risk
Human Health	Negligible	Negligible	Negligible	Low Risk
Ecological Impacts	Medium Risk	Low Risk	Low Risk	High Risk

12.5.3 Operational Stage

There will be no air quality and/or dust deposition impact from the 'Operation Phase'.

12.6 Mitigation Measures

12.6.1 Do Nothing Scenario

There will be no air quality and dust mitigation measures required for the 'Do Nothing scenario'.

12.6.2 Construction Stage

The following mitigation measures are to be implemented during the construction phase:

- Avoid unnecessary vehicle movements and manoeuvring, and limit speeds on site so as to minimise the generation of airborne dust.

- Use of receptor skips during construction activities.
- During dry periods, dust emissions from heavily trafficked locations (on and off site) will be controlled by spraying surfaces with water and wetting agents.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic only.
- Re-suspension in the air of spillages material from trucks entering or leaving the site will be prevented by limiting the speed of vehicles within the site to 10kmh and by use of a mechanical road sweeper.
- The overloading of tipper trucks exiting the site shall not be permitted.
- Aggregates will be transported to and from the site in covered trucks.
- Where the likelihood of windblown fugitive dust emissions is high and during dry weather conditions, dusty site surfaces will be sprayed by a mobile tanker bowser.
- Wetting agents shall be utilised to provide a more effective surface wetting procedure.
- Exhaust emissions from vehicles operating within the construction site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised by routine servicing of vehicles and plant, rather than just following breakdowns; the positioning of exhausts at a height to ensure adequate local dispersal of emissions, the avoidance of engines running unnecessarily and the use of low emission fuels.
- All plant not in operation shall be turned off and idling engines shall not be permitted for excessive periods.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- Material stockpiles containing fine or dusty elements including topsoils shall be covered with tarpaulins.
- Where drilling or pavement cutting, grinding or similar types of stone finishing operations are taking place, measures to control dust emissions will be used to

prevent unnecessary dust emissions by the erection of wind breaks or barriers. All concrete cutting equipment shall be fitted with a water dampening system.

- A programme of air quality monitoring shall be implemented at the site boundaries for the duration of construction phase activities to ensure that the air quality standards relating to dust deposition and PM_{10} are not exceeded The following dust deposition limits are typically recommended;
    - Dust Deposition Rate limit = 350 mg/m^2/day (averaged over a 30+/-2 day period using Bergerhoff Gauge Method).
    - Dust Deposition Rate limit affecting sensitive ecological receivers = 1,000 mg/m^2/day
    - PM_{10} 24 Hour Mean concentration limit = 50 µg/m^3 not to be exceeded more than 35 times a calendar year
    - PM_{10} Annual Mean concentration limit = 40 µg/m^3
    - $PM_{2.5}$ Annual Mean concentration limit = 25 µg/m^3

  Where levels exceed specified air quality limit values, dust generating activities shall immediately cease and alternative working methods shall be implemented. A complaints log shall be maintained by the construction site manager and in the event of a complaint relating to dust nuisance, an investigation shall be initiated.

Step 3: Site-Specific Mitigation

In accordance with the IAQM Guidance, the highest risk category should be applied when determining proposed mitigation measures. Therefore, the mitigation measures applicable to a **High-Risk site** will be applied. The proposed mitigation measures in the IAQM guidance are as follows:

General Measures

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.

Dust Management

- Dust management measures will include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
- If applicable, hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the recommended mitigation measures, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Commence baseline monitoring, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Waste Material to be disposed of at an appropriately licensed facility.

Measures specific to demolition

- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Measures specific to earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

Measures specific to construction.

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures specific to trackout.

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site logbook.
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Access gates to be located at least 10 m from receptors where possible.

12.6.3 Operation Stage

There are no air quality and dust mitigation measures required for the 'Operation Stage'.

12.7 Residual Impacts

12.7.1 Do Nothing Scenario

There is no air quality and dust impact from the 'Do Nothing scenario'.

In terms of climate impact, the proposed development will have no climate change impact as a result of the operation of the flood relief scheme. In fact, the proposed flood relief works are required as a result of climate change impacts.

As the proposed development, will have no significant negative impacts or effects on climate, mitigation measures are not proposed other than all construction machinery and plant will be maintained in good operational order while on-site and damping down of the operational areas will be carried out to reduce dust emissions, minimising any emissions that are likely to arise.

12.7.2 Construction Stage

Step 4: Determine Significant Effects

Construction site dust control measures and good construction site management and practice is capable of effectively mitigating the potential for significant impact of fugitive dust emissions. Therefore, the potential for fugitive dust emission effects at the nearest residential properties and ecological receptors will be controlled to ensure impacts are of negligible significance.

The IAQM Guidance recommends that significance is only assigned to the effect after considering the construction activity with mitigation. Therefore, the detailed mitigation measures have been defined in a form suitable for implementation by way of inclusion within the EIAR which makes up part of the planning consent.

Approximately 23 sensitive receptors have been noted within 20m of the proposed construction works. The closest works proposed are fish passage works which are approximately 17m from the River Barrow and River Nore SAC boundary. Using the IAQM methodology for the assessment of impacts from construction activities, the following is indicated in Table 1-9;

- the risk of dust soiling impacts are medium for demolition and are low for earthworks, construction and for trackout;
- the impacts on human health are negligible for demolition, earthworks and construction and are low for trackout; and
- the ecological impacts are high for trackout, medium for demolition and are low for earthworks and construction.

In accordance with the IAQM Guidance, the highest risk category measures have been applied in the determination of appropriate mitigation measures. The significance of impacts arising from the risks identified together with the proposed mitigation measures are summarised in Table 12-10.

Together with the proposed mitigation measures and the existing low background particulate (PM_{10}) concentrations, the construction phase activities on the proposed site will not cause an exceedance of the air quality objectives at receptor locations.

Table 12-10: Summary of Significance of Impact including Site-specific Mitigation.

Potential Impact	Significance			
	Demolition	**Construction**	**Earthworks**	**Trackout**
Dust Soiling	Negligible	Negligible	Negligible	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible
Ecological	Negligible	Negligible	Negligible	Negligible

12.7.3 Operation Stage

There will be no air quality and dust impact from the 'Operation Stage'.

There will be a permanent neutral climate impact due to the proposed project.

12.8 Monitoring

12.8.1 Construction Stage

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority if and when requested. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the dust management measures, record inspection results, and make an inspection log available to the local authority if and when requested.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Agree dust deposition and/or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

12.9 Interactions with other Environmental Effects

Appropriate construction phase mitigation measures have been outlined to ensure that the potential impact on the SAC will be negligible. Therefore, the impact of dust deposition in combination with other environmental effects e.g. direct loss of habitat,

pollution etc will result in a negligible effect on the SAC and any other habitats of significance.

12.10 In-combination Effects

The removal of soils, overburden and rocks during the construction phase has the potential to give rise to dust impacts, potentially giving rise to water pollution and impacts on flora and fauna and the visual landscape. Potential interactive negative impacts have been identified in Chapter 16, a full suite of appropriate mitigation measures have been included in the relevant sections of the EIAR and are listed in a schedule of mitigation included in Chapter 17.

12.11 Cumulative Effects

In relation to the in combination construction and/or operational impact of the proposed Ballyhale Flood Relief Scheme, with other proposed schemes planned in the area, the list of schemes noted from the planning chapter have been reviewed. None of these schemes will result in any significant additional construction and/or operational Air Quality & Dust impact.

12.12 Difficulties Encountered in Assessment

No difficulties were encountered in the preparation of the Air Quality & Dust Impact Assessment.