7. AIR QUALITY

7.1 INTRODUCTION

7.1.1 This chapter of the ES assesses the likely significant effects of the proposed development in terms of air quality. The assessment has been carried out by Air Quality Consultants Ltd.

7.1.2 The assessment covers the potential effects of emissions of dust associated with construction activities, as well as the operational air quality effects associated with on-site emissions from the proposed pyrolysis plant and gas engines of the ERF, and the off-site emissions arising from the vehicles accessing the ERF and rail emissions from trains using the proposed train terminal.

7.1.3 The key pollutants arising from the gas engines are: nitrogen oxides (NOx expressed as NO_2), and carbon monoxide (CO). In addition, there will be emissions to air from the pyrolyser; these are governed by the Industrial Emissions Directive (IED), which requires adherence to emission limits for the following pollutants:

- total dust (as PM10 and PM2.5);
- total organic carbon (as Benzene);
- carbon monoxide (CO)
- nitrogen oxides (NOx)
- sulphur dioxide (SO2);
- hydrogen chloride (HCl);
- hydrogen fluoride (HF);
- twelve trace metals; and
- dioxins and furans.

7.1.4 The key pollutants emitted by road traffic associated with the development are:

- nitrogen dioxide (NO_2); and
- fine particles (PM_{10} and $PM_{2.5}$).

7.1.5 Where pollutants are emitted from both point sources and road traffic, the combined effects have been assessed.

7.1.6 The proposed development includes a rail terminal platform to accommodate the transfer of material to and from the ERF.

7.1.7 During construction there will be dust emissions that need to be assessed in relation to:

- dust soiling; and
- elevated concentrations of fine particles (PM_{10} and $PM_{2.5}$).

7.1.8 The assessment of potential effects from odour associated with the ERF have been scoped out of the ES, as agreed with Wakefield District Council (WDC). Further information on the proposed development is provided in Chapter 5.

7.1.9 The chapter describes the assessment methodology; the baseline conditions at the Application Site and surroundings; the potential environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after the measures have been employed.

7.1.10 The effects have been assessed at nearby sensitive receptor locations including residential properties, neighbouring commercial premises, and sensitive habitats and ecosystems including the Fairburn and Newton Ings Site of Special Scientific Interest (SSSI) and Local Nature Reserve (LNR).

7.1.11 This chapter on air quality is supported by the information set out in Technical Appendix 7.

7.2 PLANNING POLICY CONTEXT

European Legislation

European Framework Directive on Ambient Air Quality and Cleaner Air for Europe, May 2008

7.2.1 The European Union has set limit values for seven key air pollutants, nitrogen dioxide, PM_{10}, $PM_{2.5}$, sulphur dioxide, benzene, carbon monoxide, and lead. These limit values are set out in the EU Framework Directive 2008/50/EC (2008). Achievement of these values is a national obligation and was required by 2010 for nitrogen dioxide and benzene, and 2005 for all other pollutants apart from $PM_{2.5}$, which will not apply until 2015.

European Waste Framework Directive, November 2008

7.2.2 The Waste Framework Directive (Directive 2008/98/EC) (2008b) sets out the EU member state obligations to the planning, operation and management of waste sites and processes. With respect to air quality, the Directive states:

“Member States shall take the necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment and, in particular:

1. *without risk to water, air, soil, plants or animals;*
2. *without causing nuisance through noise or odours; and*
3. *without adversely affecting the countryside or places of special interest."*

European Industrial Emissions Directive, December 2010

7.2.3 The Industrial Emissions Directive (IED) (2010/75/EU) brings together seven existing directives, including the Waste Incineration Directive, into one piece of legislation. The IED outlines total emission limit values (ELVs) for a number of pollutants typically emitted during waste incineration. These are NOx and nitrogen dioxide, NO, total dust, HCl, hydrogen fluoride, sulphur dioxide, organic substances, trace metals, and dioxins and furans. The design and operation of all new waste incinerations facilities must ensure compliance with the ELVs.

European Councils Directive on Conservation of Natural Habitats and of Wild Fauna and Flora, May 1992

7.2.4 European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (2010) (The Air Quality Standards Regulations 2010 (No. 1001), 2010), transposes the Directive into law in England and Wales. The Regulations require the Secretary of State to provide the European Commission with a list of sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs); with these classified under the Council Directive 79/409/EEC on the Conservation of Wild Birds (Directive 2009/147/EC of the European Parliament and of the Council, 2009). These sites form a network termed "Natura 2000".

National Legislation

The Environmental Permitting Regulations in England and Wales, March 2010

7.2.5 The Environmental Permitting Regulations (2010) set the legislative background for environmental permitting in England and Wales. The regulations include a commitment to minimising emissions to air from permitted processes, and include obligations of compliance with all legislated emissions limits for permitted processes, including the IED emission limits for waste incineration processes.

<u>The Environmental Permitting Regulations in England and Wales (Amendment) Regulation (2013)</u>

7.2.6 The requirements of the IED were transposed into UK law on 6th January 2013 by the Environmental Permitting (England and Wales) (Amendment) Regulations (2013). This requires that any new installation seeking a permit after 7th January 2013 be subject to the IED.

<u>The Waste (England and Wales) Regulations 2011, March 2011</u>

7.2.7 The Waste Framework Directive 2008/98/EC and its obligations, including those on air quality, is transposed in English law by The Waste (England and Wales) Regulations 2011 (2011).

<u>The UK Air Quality Strategy, 2007</u>

7.2.8 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) provides the policy framework for air quality management and assessment in the UK. It provides air quality standards (AQS) and objectives for key air pollutants, which are designed to protect human health and the environment (Defra, 2007). The 'standards' are set as pollutant concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale.

7.2.9 The Strategy also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives (AQO). Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

<u>Air Quality (England) Regulations, 2000 and Air Quality (England) (Amendment) Regulations 2002</u>

7.2.10 Some of the objectives are for the use of local authorities as part of the LAQM regime, and these are set out in regulations.

Air Quality Standards Regulations, 2010

7.2.11 The air quality limit values set out in EU Directive 2008/50/EC are transposed in English law by the Air Quality Standards Regulations 2010 (2010). This imposes duties on the Secretary of State relating to achieving the limit values.

The Conservation of Habitats and Species Regulations 2010

7.2.12 The Conservation of Habitats and Species Regulations (2010) transposes the Habitats Directive (EC Directive 92/43/EEC) into law in England and Wales. The Regulations require the Secretary of State to compile and maintain a register of European designated habitats, to include SACs and SPAs; with the latter classified under the Council Directive 79/409/EEC on the Conservation of Wild Birds.

7.2.13 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

7.2.14 In addition to SACs and SPAs, some internationally important UK sites are designated under the Ramsar Convention. Originally intended to protect waterfowl habitat, the Convention has broadened its scope to cover all aspects of wetland conservation.

7.2.15 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on the European site. Where this is the case, it has to carry out an ‘appropriate assessment’ in order to determine whether the development will adversely affect the integrity of the site.

The Wildlife and Countryside Act 1981

7.2.16 Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act (1949), SSSIs have been re-notified under the Wildlife and Countryside Act (1981).

The Countryside and Rights of Way Act 2000

7.2.17 Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way Act (2000) (the “CROW” Act). If a development is “likely to damage” a SSSI, the CROW Act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW Act also provides protection to local nature conservation sites, which can be particularly important in providing ‘stepping stones’ or ‘buffers’ to SSSIs and European sites.

7.2.18 In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

National Planning Policy

National Planning Policy Framework, March 2012

7.2.19 The National Planning Policy Framework (NPPF) (NPPF, 2012) introduced in March 2012 now sets out planning policy for the UK in one place. It replaces previous Planning Policy Statements, including PPS23 on Planning and Pollution Control. The NPPF contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account, as well as the EU limit values or national objectives for pollutants, the presence of any AQMAs and the appropriateness of both the development for the site, and the site for the development.

7.2.20 The NPPF places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should "contribute to…reducing pollution". To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the effects of pollution on health and the sensitivity of the area and the development should be taken into account.

7.2.21 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

7.2.22 The NPPF also sets out the National planning policy on biodiversity and conservation. This emphasises that the planning system should seek to minimise impacts on biodiversity and provide net gains in biodiversity wherever possible as part of the Government's commitment to halting declines in biodiversity and establishing coherent and resilient ecological networks.

7.2.23 PPS10 on Planning for Sustainable Waste Management (HMSO, 2011), which has not been replaced by the NPPF, sets out several objectives for 'sustainable' waste management. The overall objective of the Government policy on waste is to protect human health and the environment by producing less waste and by using it as a resource wherever possible. PPS10 contains Annex E, for consideration of local environmental impacts, including dust, odours and litter. In considering planning applications for waste management facilities waste planning authorities should consider the likely impact on the local environment and on amenity, i.e. through consideration of the proximity of sensitive receptors and the extent to which adverse emissions can be controlled through the use of appropriate and well-maintained and managed equipment.

Local Planning Policy

Wakefield Local Development Framework and Core Strategy, Adopted 2009

7.2.24 Changes to the planning legislation require the Council to implement a Local Development Framework (LDF). The LDF is a portfolio of planning documents, individually known as Local Development Documents, will deliver the spatial development strategy for Wakefield and build upon existing local and regional strategies and initiatives.

7.2.25 The Core Strategy (WDC, 2009) sets out Policy CS 10 – Design, Safety and Environmental Quality, which states that:

"In all parts of the district, new development will:

e. minimise the risk from all forms of pollution and contamination for existing and future occupants, the wider community and the environment, particularly within the defined Air Quality Management Areas along the M1, M62 and A1 corridors and in the urban areas in the western and northern parts of the district."

7.2.26 Development Policy D20 – Pollution Control (Wakefield MBC, 2010), also states that:

"Development proposals which are likely to cause pollution or are likely to be exposed to potential sources of pollution will only be permitted if it can be demonstrated that measures can be implemented to minimise emissions to a satisfactory level that protects health, environmental quality and amenity."

7.2.27 With respect to designated ecological sites, local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife sites will be judged, making distinctions between different levels of site designation. If significant harm from a development cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

Air Quality Action Plan

7.2.28 WDC has declared eight AQMAs, one of which is located in Castleford. The Castleford AQMA is declared for nitrogen dioxide and covers the area around the A6032 and A656 (see Technical Appendix 7.5). The Council has developed an Air Quality Action Plan for the Castleford AQMA (WDC, 2012) which is currently out for consultation.

Key Guidance Documents

Environment Agency Guidance

7.2.29 The Environment Agency's H1 Environmental Risk Assessment Guidance Note (Environment Agency, 2011a) provides methods for quantifying the environmental impacts of emissions to all media; Annex F of H1 covers Emissions to Air. It contains long- and short-term Environment Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and International sources.

7.2.30 In addition, the Environment Agency's Interim Guidance Note for Metals provides guidance for Applicants for Environmental Permits, on how to consider the air quality impacts from Group III metal stack emissions from incineration and co-incineration plant (including energy from waste) (Environment Agency, 2012).

Health and Safety Executive, Workplace Exposure Limits, 2005

7.2.31 The Health and Safety Executive's EH40/2005 Workplace exposure limits (HSE, 2005) document contains a list of the workplace exposure limits for use with the control of substances hazardous to health regulations. In the absence of AQOs and EALs for the pollutants assessed in this chapter, the emissions limits in EH40 have been used.

7.3 ASSESSMENT METHODOLOGY

Study Area

7.3.1 For the purposes of this air quality assessment the study area has been defined using a combination of the following:

- Construction phase
  - within 350 m of the site boundary
- Operational phase:
  - all road links likely to be materially affected by the proposed development;
  - the proposed train terminal platform;
  - areas likely to be materially affected by the pyrolyser and gas engine emissions of the proposed ERF.
  - monitoring locations used for model verification; and
  - ecological areas within 2 km and international designations within 10 km of the proposed ERF.

Consultation

7.3.2 The assessment follows a methodology agreed with WDC via a telephone discussion and email between Stephen Douglas (Scientific Officer at WDC) and Suzanne Hodgson (Air Quality Consultants) held on 27th June 2012.

Existing Conditions

7.3.3 Existing sources of emission within the study area have been defined using a number of approaches. A site visit (undertaken on 2 July 2012) has been carried out to identify existing sources from a visual inspection of the area. Industrial and waste management sources that exist close to the Application Site have been identified to determine the likelihood of cumulative effects of multiple point sources. They have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2012c). Local sources have also been identified through discussion with WDC's Environmental Health Services, as well as through examination of the Council's air quality Review and Assessment reports.

7.3.4 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers both the study area and nearby sites, the latter being used to provide context for the assessment. The background concentrations across the study area have been defined using the national pollution maps published by Defra (2012a). These cover the whole country on a 1x1 km grid.

Operational Effects

<u>Sensitive Locations</u>

7.3.5 The assessment considers concentrations for specified human and ecological receptors and concentrations across a modelled grid. Further details of the receptors assessed are provided in Technical Appendix 7.1.

<u>Human Receptors</u>

7.3.6 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. The annual mean objectives are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide and 15-minute mean objective for sulphur dioxide apply wherever members of the public might regularly spend 1-hour, or more, or 15 minutes, or more, respectively, including outdoor eating locations and pavements of busy shopping streets.

7.3.7 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ arising from emissions from traffic have been predicted at a number of locations close to the proposed development. In addition, concentrations of nitrogen dioxide and carbon monoxide associated with the proposed pyrolysis plant and gas engines; and PM_{10}, $PM_{2.5}$, sulphur dioxide, total organic carbon (as benzene), HCl , hydrogen fluoride, toxic metals dioxins and furans associated with the proposed pyrolysis plant, have also been predicted for assessment of the effects of emissions from the ERF stacks.

Ecological Receptors

7.3.8 The Environment Agency's H1 guidance states that the impact of emissions to air on vegetation and ecosystems should be assessed for the following habitat sites within 10 km of the source:

- Special Areas of Conservation (SACs) and candidate SACs (cSACs) designated under the Habitats Directive;
- Special Protection Areas (SPAs) and potential SPAs designated under the Birds Directive ; and
- Ramsar Sites designated under the Convention on Wetlands of International Importance.

Within 2 km of the source:

- Sites of Special Scientific Interest (SSSI) established by the 1981 Wildlife and Countryside Act;
- National Nature Reserves (NNR);
- Local Nature Reserves (LNR);
- local wildlife sites; and
- ancient woodland.

7.3.9 There are no European or internationally designated sites within 10 km of the proposed ERF facility. Within 2 km there is the Fairburn and Newton Ings SSSI/LNR, which has been assessed.

Assessment Scenarios

Road Traffic Effects

7.3.10 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2011), and the proposed year of opening (2015). For 2015, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). A further 2015 sensitivity test has been carried out for nitrogen dioxide that involves assuming no reduction in emission factors for road traffic from the baseline year. This is to address the issue recently identified by Defra (Carslaw et al., 2011) that road traffic emissions have not been declining as expected (see later section on Uncertainty). Nitrogen dioxide concentrations in 2015 with and without the scheme are thus presented for two scenarios: 'With Emissions Reduction' and 'Without Emissions Reduction'.

Rail Effects

7.3.11 An assessment of the potential effects of rail emissions at the proposed freight terminal has not been included, as this planning application covers the construction of the freight terminal only. Additional assessments will be required to evaluate the operation impacts once the number of rail movements and volumes of waste to be transported by rail have been identified.

ERF Stack Emission Effects

7.3.12 Predictions of pollutants emitted from the ERF stacks have been carried out for the 'With Scheme' scenario.

7.3.13 For assessment of effects on human health, nitrogen dioxide, PM_{10} and $PM_{2.5}$, concentrations arising from the ERF stacks have been added to predicted road traffic concentrations, to provide a total combined effect at specified receptors and across a modelled grid, where relevant. For the other assessed pollutants (sulphur dioxide, TOC, HCl, hydrogen fluoride, trace metals, and dioxins and furans) the ERF stack emissions have been assessed in isolation since there is no associated road effect with these pollutants.

7.3.14 For assessment of effects on ecological health, the assessment of the relevant pollutants has been carried out for the ERF stack emissions only. For the assessment of road schemes, the Highways Agency requires an assessment of the effects of roads traffic emissions on conservation sites (Designated Sites) within 200 m of a road (Highways Agency, 2007). The SSSI is located more than 200 m from any main roads and therefore the effects of development traffic on the SSSI have not been assessed.

Modelling Methodology

7.3.15 For the roads, pollutant concentrations have been predicted for the baseline and future years using the ADMS-Roads (v3.1) dispersion model. For the ERF stacks, pollutant concentrations have been predicted using ADMS-5 dispersion model. These models have been widely used in the UK for this type of assessment. Further details on the modelling methodology used for the assessment are provided in Technical Appendix 7.2.

Construction Effects

7.3.16 Locations sensitive to dust emitted during construction will be places where members of the public are regularly present. Residential properties and commercial operations close to the site will be most sensitive to construction dust. Any areas of sensitive vegetation or ecology that are very close to dust sources may also be susceptible to some negative effects.

7.3.17 It is very difficult to quantify emissions of dust from construction activities. It is thus common practice to provide a qualitative assessment of potential effects, making reference to the assessment criteria set out Appendix 7.3.

Assessment Criteria

Health Criteria

7.3.18 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

7.3.19 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020.

7.3.20 The UK objectives for nitrogen dioxide and PM_{10} are the same as the EU limit values. The EU limit value for $PM_{2.5}$ is the same as the UK objective, but is to be met by 2015.

7.3.21 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2009).

7.3.22 Where there is no EAL quoted in Environment Agency guidance, one has been derived from the Health and Safety Executive's workplace exposure limits (HSE, 2005). This applies to the short term EAL for chromium VI, and the short- and long-term EALs for thallium and cobalt.

7.3.23 There are no assessment criteria for dioxins and furans. The World Health

Organisation (WHO,2000) provides an indicator on the air concentrations above which WHO consider it necessary to identify and control local emission sources; this value is 0.3 pg/m^3 (300 fg/m^3). In the absence of suitable criteria, the process contributions have been compared against the relevant background concentration, as well as the WHO indicator concentration for which it is considered necessary to identify and control emission sources.

Vegetation and Ecosystem Criteria

7.3.24 Objectives for the protection of vegetation and ecosystems, set by the UK Government, are summarised in Technical Appendix 7.1 and are the same as the EU limit values. The objectives only strictly apply a) more than 20 km from an agglomeration (about 250,000 people), and b) more than 5 km from Part A industrial sources, motorways and built up areas of more than 5,000 people. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally designated conservation sites and SSSIs.

7.3.25 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by the United Nations Economic Commission for Europe (UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The critical loads for the ecosystems under consideration in this assessment, as defined in the Air Pollution Information System (APIS, 2007), are provided in Technical Appendix 7.1.

7.3.26 Where there is no air quality objective, the Environment Agency’s EALs have been applied.

Environment Agency Screening Criteria

7.3.27 The Environment Agency has adopted criteria that allow process contributions to be screened out as insignificant regardless of the baseline environmental conditions Environment Agency (2011). The emissions from a process can be considered to be insignificant if:

- the long-term (annual mean) process contribution is <1% of the long-term environmental standard; and
- the short-term (24-hour mean or shorter) process contribution is <10% of the short-term environmental standard.

7.3.28 It should be recognised that these criteria determine when an effect can be screened out as insignificant. They do not imply that effects will necessarily be significant above these levels, but that above these levels there is a potential for significant effects that should be assessed using a detailed assessment methodology such as detailed dispersion modelling (as has been carried out for this project in any event) and taking into account background concentrations.

7.3.29 In addition, Environment Agency H1 guidance explains that *"As a guide, detailed dispersion modelling of long term emissions maybe useful where:*

- *local receptors may be sensitive to long term emissions;*
- *released substances fall under an Air Quality Management Plan;*
- *the sum of the background concentration and process contribution exceed 70% of the appropriate long term standard";*

and that: *"As a guide, detailed dispersion modelling of short term emissions maybe useful where:*

- *local receptors maybe sensitive to short term emissions;*
- *the short term process contribution is more than 20% of the relevant short term environmental standard minus twice the long term background concentration."*

7.3.30 For the assessment of trace metals, the Environment Agency's Interim Guidance Note for Metals has been used. The guidance note applies to Group III metals in stack emissions, but the approach has been used for all metals. It provides a three step approach to the assessment, which is outlined below:

- Step 1 – Screening Scenario: Model predictions assume each metal is emitted at the maximum Emission Limit Value (ELV) of 0.5 mg/Nm^3 as a worst-case. Assessment of the impact is then made against the following parameters:
  - Long-term Process Contribution (PC) < 1% or short-term PC < 10% of the EAL; or
  - Long-term and short-term Predicted Environmental Concentrations (PEC)[1] <100% of the EAL (taking likely modelling uncertainties into account)
- Step 2 – Worst Case Scenario Based On Currently Operating Plant: Where the Step 1 screening criteria set out in the guidance are not met, an emission concentration equal to $1/9^{th}$ of the ELV for Group III metals and $1/3^{rd}$ of the ELV for Group I and II metals have been assumed, and assessment made against the same criteria specified for Step 1.

[1] PEC = Process Contribution + Background Concentration

- Step 3: If the screening criteria are not met in Step 2, typical emission concentrations for ERFs have been used, as specified in the guidance. The guidance does not specify typical emission concentrations for cadmium. In the absence of this, typical emission concentrations for cadmium from ERFs have been taken from a study undertaken by ERM on Emissions from Waste Facilities (ERM, 2011).

Assessment of Significance

7.3.31 There is no official guidance in the UK on how to describe air quality effects nor to assess their significance. The approach developed by the IAQM (IAQM, 2009), and incorporated in Environmental Protection UK's (EPUK) guidance document on planning and air quality (EPUK, 2010), has therefore been used. This approach includes elements of professional judgement. Full details of this approach are provided in Technical Appendix 7.4.

7.3.32 As described above, where there is no air quality objective, the EALs have been applied. The approach taken in this assessment is to use detailed dispersion modelling in the first instance, and to apply the Environment Agency screening criteria to the model outputs. Where process contributions are shown to be below these screening criteria, they are judged to be insignificant.

7.3.33 AQOs, EALs and criteria derived from the HSE workspace exposure limits, that have been used to assess the effects of the proposed development are presented in Appendix 7.1.

7.3.34 In the case of nitrogen dioxide, PM_{10} and $PM_{2.5}$, where this initial screening shows a requirement for a more detailed assessment, then total concentrations have been calculated and assessed following the IAQM guidance described in Technical Appendix 7.2.

7.3.35 In the case of nitrogen oxides, sulphur dioxide and hydrogen fluoride concentrations and the nitrogen and acid deposition rates at the SSSI, where this initial screening shows the potential for significant effects, then the predicted total concentrations have been assessed against the critical levels and critical loads described in Technical Appendix 7.2.

7.3.36 In the case of the sulphur dioxide, TOC, HCl, hydrogen fluoride and carbon monoxide, if the EAL is exceeded, interrogation of the area of exceedence has been undertaken to determine if there is relevant exposure at the location.

Construction Dust Criteria

7.3.37 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (IAQM) (IAQM, 2011) has therefore been used. Full details of this approach are provided in Technical Appendix 7.2.

7.3.38 In the absence of official guidance, the approach developed by the IAQM (IAQM, 2011) to assess the significance of construction dust has been used. This approach includes elements of professional judgement. Full details of this approach are provided in Technical Appendix 7.3.

7.4 BASELINE CONDITIONS

Site Location

7.4.1 The proposed development site is located approximately 800 m to the east of Castleford town centre, which has been declared an Air Quality Management Area by WDC. The site is bounded by Wheldon Road to the north and a railway line to the south. There are existing residential properties in the areas of Wheldale, Castleford and Airedale which are located approximately 600 m to the east, 500 m to the southeast and 170 m to the south, respectively, of the Application Site. Approximately 250 m northeast of the Application site is the commercial area of Castleford Ings and 500 m to the north is the Fairburn and Newton Ings SSSI/LNR.

Existing Industrial and Railway Sources

7.4.2 A search of the UK Pollutant Release and Transfer Register website (Defra, 2012c) identified one industrial process (the Eon Cogeneration combined heat and power (CHP) plant), located within 1 km of the Application Site. In addition, a number of other industrial processes (a confectionary factory and a timber treatment centre) were identified during the site visit. The railway line immediately south of the Application Site boundary runs freight, but no passenger trains.

7.4.3 Emissions from the industrial processes and the railway line will already be included within Defra's background maps. Traffic associated with the operation of the industrial facilities will have been included in the current and future baseline traffic data. The probability of short-term emissions from the various industrial processes occurring in the same location at the same time is extremely low due to the geography of the stacks, and therefore the chances of impacts combining and exceeding the short-term AQO/EALs are also extremely low.

Wakefield District Council Monitoring

7.4.4 WDC has investigated air quality within its area as part of its responsibilities under the LAQM regime. In June 2007, an AQMA was declared in Castleford town centre, in the area around the A6032 and the A656 (WDC, 2011). The Castleford AQMA is located approximately 700 m west of the application site and is shown in Technical Appendix 7.5. Seven further AQMAs have also been declared by the Council, however these are located some distance from the application site and are unlikely to affect or be affected by the proposed development.

7.4.5 In terms of PM_{10}, WDC concluded that there are no exceedences of the objectives. It is therefore highly unlikely that existing PM_{10} levels will exceed the objectives within the study area (WDC, 2011).

7.4.6 WDC operates seven permanent automatic monitoring stations within its area, one of which is located within Castleford (located approximately 1 km from the Application Site), along Pontefract Road, measuring both nitrogen dioxide and PM_{10}. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Harwell Scientifics (using the 50% TEA in acetone method). Results for the years 2007 to 2011 and PM_{10} monitoring results are presented in Technical Appendix 7.5.

7.4.7 Monitored annual mean concentrations exceeded the annual mean nitrogen dioxide objective at diffusion tubes along Ferrybridge Road, the eastern end of Savile Road and Pontefract Road in recent years. Annual mean concentrations are below the objective at diffusion tubes at the western end of Savile Road and Wood Street. The measured concentrations at the automatic analyser on Pontefract Road were below the annual mean objective and there have been no exceedences of the 1-hour objective value since monitoring commenced at the new site in 2009.

7.4.8 There are no clear trends in monitoring results for the past five years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards. The implications of this are discussed later in Section 7.5 of this chapter.

7.4.9 Measured PM_{10} concentrations at automatic monitor on Pontefract Road were below the annual mean objective and there have been no exceedences of the 24-hour objective value since monitoring commenced at the new site in 2009.

Background Concentrations

7.4.10 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2011 and the opening year 2015. These are presented in Appendix 7.5. In the case of nitrogen oxides and nitrogen dioxide, two sets of future-year backgrounds are presented to take into account uncertainty in future year vehicle emission factors. The derivation of background concentrations is described in Technical Appendix 7.2. The background concentrations are all well below the objectives.

7.4.11 For sulphur dioxide and carbon monoxide predicted annual mean background concentration maps for the whole of the UK were issued as part of the original technical guidance for Local Air Quality Management (LAQM.TG(03)). For 2001 the background concentrations for the grid where the ERF is proposed were predicted to be 6.2 $\mu g/m^3$ for sulphur dioxide and 0.36 mg/m^3 for carbon monoxide.

7.4.12 There is little data available on background concentrations of the other pollutants assessed, as they are typically measured only close to sources of pollution.

7.4.13 Estimated background nitrogen deposition rates (2009 – 2011) in the study area have been obtained from the APIS website (APIS, 2007). These are presented in Technical Appendix 7.5. These shown that the background deposition rates are in excess of the critical load.

Baseline Conditions for Trace Metals

7.4.14 Defra has undertaken monitoring of trace elements at a number of locations in the UK since 1976 as part of the UK Urban and Rural Heavy Metals Monitoring Networks. To provide an indication of the range of trace metal concentrations that occur in the Yorkshire area, measured concentrations at four nearby monitoring sites (Sheffield Centre, Sheffield Brinksworth, Scunthorpe Town and Scunthorpe Low Santon), in 2011, have been summarised and are provided in Technical Appendix 7.5.

Baseline Conditions for Dioxins and Furans

7.4.15 Monitoring of PCDD/Fs (dioxins and furans) is currently carried out by Defra at seven locations in the UK (Hazelrigg, High Muffles, London, Manchester, Auchencorth Moss, Middlesbrough and Weybourne).

7.4.16 To provide an indication of the range of PCDD/Fs concentrations that occur in the UK, a summary of the annual mean concentrations measured between 2008 and 2010 is presented in Appendix 7.5. The average concentration measured in Manchester, the nearest monitoring site to the Application Site, from 2008 to 2010 is 27.3 fg/m^3. This monitoring data is assumed to be representative of the baseline dioxin and furan concentrations at the Application site.

Predicted Baseline Concentrations

7.4.17 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations. These locations are shown in Technical Appendix 7.1. The results, which cover both existing (2011) and future year (2015) baseline (Without Scheme), are presented in Table 7.1 and Table 7.2. The future baseline for nitrogen dioxide covers the two scenarios: with the official reductions in vehicle emission factors and without these reductions. The modelled road nitrogen oxides contributions have been adjusted by a verification factor of 3.2 and the total NO_2 has been adjusted by a secondary verification factor of 0.99, see Technical Appendix 7.2 for details of the model verification.

7.4.18 Predicted annual mean concentrations of nitrogen dioxide exceed the objective at 20 Saville Road (R30) in 2011; at other modelled receptors the objective is predicted to be achieved. Assuming that road traffic emissions do not decline, the objective continues to be exceeded in 2015 at R30. The objective continues to be achieved at all other modelled receptors in both emissions reduction scenarios. All of the predictions for PM_{10} and $PM_{2.5}$ are well below the objectives (or limit values).

Table 7.1: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide ($\mu g/m^3$) at Existing Human Receptors

Receptor	Receptor Name	2011	2015 Without Scheme	
			With 'Official' Emissions Reduction [a]	Without Emissions Reduction [b]
R1	Elder Bank House	18.4	15.3	17.4
R2	1 Fairview	18.9	15.6	17.9
R3	36 Stansfield Close	18.7	15.8	17.4
R4	Wheldale Court	16.1	13.7	15.0
R5	22-29 Stansfield Close	18.7	15.8	17.4
R6	41 Foss Walk	18.6	15.8	17.4
R7	10 South View	15.6	13.2	14.6
R8	323 Fryston Road	15.6	13.2	14.6
R9	Hilltop Close	16.2	13.8	15.1
R10	161 Healdfield Road	18.8	15.9	17.5
R11	101 Healdfield Road	24.1	20.7	22.4
R12	Healdfield Road	20.3	17.7	19.1
R13	Healdfield Road	24.2	20.7	22.5
R14	Castleford High School	24.8	21.2	23.1
R15	6 Boston Street	25.0	21.3	23.3
R16	7 Lincoln Street	25.0	21.3	23.3
R17	62 Princess Street	24.4	20.9	22.7
R18	12 Princess Street	21.0	18.2	19.8
R19	1 Hepworth Street	21.6	18.6	20.4
R20	118 Wheldon Street	24.1	20.4	23.0
R21	128 Wheldon Street	24.2	20.4	23.0
R22	92 Wheldon Street	31.5	25.6	30.6
R23	1 Queen Street	22.8	19.5	21.7
R24	Above Gibson Comps	30.7	25.3	29.2
R25	St. Joseph's School	27.9	23.3	26.3
R26	Above Magic Wok	28.6	23.8	27.0
R27	Above One Call Accountants	22.1	18.0	21.0
R28	Above Star Fisheries	30.7	25.3	29.2
R29	Above The Lion	29.3	24.3	27.7
R30	20 Saville Road	**44.7**	35.6	**43.2**
R31	1 Bridge Street	34.0	27.7	32.7
Objective		**40**		

[a] This assumes vehicle emission factors reduce into the future at the current 'official' rates.
[b] This assumes vehicle emission factors in 2015 remain the same as in 2011.

Table 7.2: Modelled Baseline Concentrations of PM_{10} and $PM_{2.5}$ at Existing Human Receptors

Receptor	PM_{10} [a]				$PM_{2.5}$	
	Annual Mean (μg/m³)		No. Days >50 μg/m³		Annual Mean (μg/m³)	
	2011	2015 Without Scheme	2011	2015 Without Scheme	2011	2015 Without Scheme
R1	16.8	16.1	1	<1	11.1	10.5
R2	16.9	16.2	1	<1	11.2	10.5
R3	17.6	16.9	1	1	12.1	11.4
R4	16.3	15.7	<1	<1	10.8	10.2
R5	17.6	16.9	1	1	12.1	11.4
R6	17.6	16.9	1	1	12.1	11.4
R7	16.9	16.3	1	<1	11.2	10.6
R8	16.9	16.3	1	<1	11.2	10.6
R9	16.3	15.7	<1	<1	10.8	10.2
R10	17.6	16.9	1	1	12.2	11.5
R11	17.1	16.3	1	<1	11.8	11.0
R12	15.6	15.1	<1	<1	10.6	10.1
R13	17.1	16.3	1	<1	11.8	11.0
R14	17.2	16.4	1	<1	11.9	11.1
R15	17.3	16.4	1	<1	12.0	11.1
R16	17.3	16.4	1	<1	12.0	11.1
R17	17.2	16.3	1	<1	11.9	11.0
R18	15.7	15.2	<1	<1	10.7	10.2
R19	15.8	15.4	<1	<1	10.8	10.3
R20	16.4	15.8	<1	<1	11.2	10.6
R21	16.4	15.8	<1	<1	11.2	10.6
R22	18.0	17.3	1	1	12.3	11.5
R23	16.1	15.6	<1	<1	11.0	10.4
R24	18.5	17.5	2	1	12.8	11.8
R25	17.8	16.9	1	1	12.3	11.4
R26	17.9	17.0	1	1	12.4	11.5
R27	17.6	16.8	1	1	11.5	10.7
R28	19.2	18.1	2	2	13.1	12.1
R29	18.9	17.9	2	1	12.9	11.9
R30	22.0	20.4	6	4	15.1	13.5
R31	19.0	17.9	2	1	13.2	12.0
Objective	**40**	**40**	**35**	**35**	**25** [b]	**25** [b]

[a] The numbers of days with PM_{10} concentrations greater than 50 μg/m³ have been estimated from the relationship with the annual mean concentration described in LAQM.TG(09) (Defra, 2009).

[b] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 μg/m³ is to be met by 2015.

7.5 POTENTIAL SIGNIFICANT EFFECTS

Construction

7.5.1 The construction works will give rise to a risk of dust effects during earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. There are various sensitive receptors that may be affected by dust, including residential properties, and less sensitive commercial premises. There are no sensitive ecological receptors near to the Application Site boundary that might be affected.

7.5.2 The Fairburn and Newton Ings SSSI is located approximately 500 m north of the Application site, and at this distance it considered there will be no significant effects on the SSSI from on-site construction activities.

Demolition

7.5.3 There is no requirement for demolition on site.

Earthworks

7.5.4 The site covers some 3.5 hectares and most of this will be subject to earthworks, which will occur predominantly on the main site where the ERF buildings will be located.

7.5.5 Some earthworks will occur in the vicinity of the proposed train terminal platform, where there will be approximately six receptors within 20 m, and a further 60 between 20 to 100 m of the area subject to works. There will be a small number of dwellings (approximately 30) and Castleford Tigers Rugby Football Ground between 100 - 200 m from the main site. There will be a large number of dwellings (approximately 450) and commercial premises between 200 – 350 m from the whole site (ERF buildings and proposed train terminal platform), on all sides. It is noted that the earthworks associated with the development of the train terminal platform is covered by Network Rails planning application (12/00998/FUL) which has been approved.

7.5.6 The earthworks will last around six months and dust will arise mainly from the vehicles travelling over unpaved ground and from the handling of dusty materials. Most of the earthworks will involve the removal of subsoil, which will largely be damp and not prone to creating dust. The dust emission class for the earthworks is considered to be large, using the criteria outlined in Technical Appendix 7.3.

Construction Activities

7.5.7 The construction will involve a total building volume of less than 25,000 m^3. Dust will arise from vehicles travelling over unpaved ground and the handling and storage of dusty materials. There will be approximately six sensitive receptors within 20 m, and a further 60 between 20 to 100 m of the area subject to construction activities near to the proposed train terminal platform. There will also be a small number of dwellings (approximately 30) and Castleford Tigers Rugby Football Ground between 100 - 200 m of the main site. There will be a large number of dwellings (approximately 450) and commercial premises between 200 – 350 m from the whole site, on all sides. The construction will take place over a 16 to 18 month period. The dust emission class for the construction is considered to be small, using the criteria outlined in Technical Appendix 7.3.

Trackout

7.5.8 The exact number of vehicles accessing the site, which may track out dust and dirt is currently unknown, however it is considered likely there will be less than 25 vehicle movements per day. The nearest sensitive receptors within 50 m of the site entrance/exit, which may be affected by dust, lie 50 m from the public highway. The dust emission class for trackout is considered to be small, using the criteria outlined in Technical Appendix 7.3.

Risk and Significance

7.5.9 Using the criteria in Technical Appendix 7.3. the risk categories for the three construction activities are judged to be as set out in Table 7.3 below.

Table 7.3: Summary of Risk of Effects Without Mitigation

Source	Dust Soiling	PM_{10} effects
Earthworks	Medium Risk Site	Medium Risk Site
Construction	Low Risk Site	Low Risk Site
Trackout	Negligible	Negligible

7.5.10 Using the criteria set out in Technical Appendix 7.4, the sensitivity of the area around the site to dust soiling and PM_{10} effects from construction activities is judged to medium.

7.5.11 On this basis the significance of dust effects without mitigation would be as set out in Table 7.4 below (using the criteria in Technical Appendix 7.4).

Table 7.4 Summary Significance Table Without Mitigation

Source	Dust soiling effects	PM_{10} effects
Earthworks	Negligible	Negligible
Construction	Negligible	Negligible
Trackout	Negligible	Negligible
Overall significance	**Negligible**	

Operation

Road Traffic

7.5.12 It should be noted that the traffic data used in the assessment assume that all material delivered to/from the ERF would be transported via road. The implications of this assumption are considered later in this section.

Human Exposure

7.5.13 Predicted annual mean concentrations of nitrogen dioxide at specified receptors are set out in Tables 7.5 and Table 7.6 for both the "Without Scheme" and "With Scheme" scenarios (outlined in Section 7.3), for two scenarios to reflect current uncertainty in Defra's future-year vehicle emission factors. For the "With Scheme" scenario results are presented for 'traffic only' and for 'traffic and ERF stack emissions'. The tables also describe the effects at each receptor using the impact descriptors given in Technical Appendix 7.6.

With Emission Reduction

7.5.14 The annual mean nitrogen dioxide concentrations are below the objective at all receptors with emissions reduction for both with 'traffic only' and for 'traffic and ERF stack emissions'.

7.5.15 The magnitude of change is small at six receptors, in both the with 'traffic only' and 'traffic and ERF stack emissions' scenarios. The maximum predicted effect is slight adverse at one receptor (20 Saville Road (R30)); at all other receptors the effect is negligible.

Without Emission Reduction

7.5.16 Assuming no reduction in emissions from road traffic, for both the with 'traffic only' and the 'traffic and ERF stacks' scenarios, the annual mean nitrogen dioxide concentrations are below the objective at all receptors, apart from at 20 Saville Road (R30). Receptor 30 is within the AQMA.

7.5.17 The magnitude of change is medium at one receptor (R22) and small at eight receptors in the with 'traffic only' and 'traffic and ERF stack emissions' scenarios. The maximum predicted effect is slight adverse at two receptors (R22 and R30); at all other receptors the effect is negligible.

Table 7.5: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2015 (μg/m^3), With 'Official' Emission Reduction [a]

Receptor	Without Scheme	Annual Mean Concentration With Scheme		Impact Descriptor	
		(Traffic only)	(Traffic and ERF stacks)	(Traffic only)	(Traffic and ERF stacks)
R1	15.3	15.7	15.8	Negligible	Negligible
R2	15.6	16.1	16.2	Negligible	Negligible
R3	15.8	15.8	15.9	Negligible	Negligible
R4	13.7	13.7	13.8	Negligible	Negligible
R5	15.8	15.8	15.9	Negligible	Negligible
R6	15.8	15.8	15.9	Negligible	Negligible
R7	13.2	13.2	13.2	Negligible	Negligible
R8	13.2	13.2	13.2	Negligible	Negligible
R9	13.8	13.8	13.9	Negligible	Negligible
R10	15.9	15.9	16.0	Negligible	Negligible
R11	20.7	20.7	20.8	Negligible	Negligible
R12	17.7	17.8	17.8	Negligible	Negligible
R13	20.7	20.7	20.8	Negligible	Negligible
R14	21.2	21.2	21.2	Negligible	Negligible
R15	21.3	21.3	21.3	Negligible	Negligible
R16	21.3	21.3	21.3	Negligible	Negligible
R17	20.9	21.0	21.0	Negligible	Negligible
R18	18.2	18.4	18.4	Negligible	Negligible
R19	18.6	18.9	18.9	Negligible	Negligible
R20	20.4	21.1	21.1	Negligible	Negligible
R21	20.4	21.1	21.2	Negligible	Negligible
R22	25.6	27.5	27.5	Negligible	Negligible
R23	19.5	19.8	19.8	Negligible	Negligible
R24	25.3	25.4	25.4	Negligible	Negligible
R25	23.3	23.4	23.4	Negligible	Negligible
R26	23.8	23.9	23.9	Negligible	Negligible
R27	18.0	18.0	18.1	Negligible	Negligible
R28	25.3	25.5	25.6	Negligible	Negligible
R29	24.3	24.5	24.5	Negligible	Negligible
R30	35.6	36.3	36.3	Slight Adverse	Slight Adverse
R31	27.7	27.8	27.9	Negligible	Negligible
Objective	**40**			-	-

[a] This assumes vehicle emission factors reduce into the future at the current 'official' rates.

[b] This assumes vehicle emission factors in 2015 remain the same as in 2011.

Table 7.6: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2015 (µg/m^3), Without 'Official' Emission Reduction [a]

Receptor	Without Scheme	Annual Mean Concentration		Impact Descriptor	
		With Scheme			
		(Traffic only)	(Traffic and ERF stacks)	(Traffic only)	(Traffic and ERF stacks)
R1	17.4	18.2	18.3	Negligible	Negligible
R2	17.9	18.8	18.9	Negligible	Negligible
R3	17.4	17.5	17.5	Negligible	Negligible
R4	15.0	15.1	15.1	Negligible	Negligible
R5	17.4	17.4	17.5	Negligible	Negligible
R6	17.4	17.4	17.5	Negligible	Negligible
R7	14.6	14.7	14.7	Negligible	Negligible
R8	14.6	14.7	14.7	Negligible	Negligible
R9	15.1	15.2	15.2	Negligible	Negligible
R10	17.5	17.6	17.7	Negligible	Negligible
R11	22.4	22.4	22.5	Negligible	Negligible
R12	19.1	19.1	19.2	Negligible	Negligible
R13	22.5	22.5	22.6	Negligible	Negligible
R14	23.1	23.2	23.2	Negligible	Negligible
R15	23.3	23.3	23.3	Negligible	Negligible
R16	23.3	23.4	23.4	Negligible	Negligible
R17	22.7	22.8	22.8	Negligible	Negligible
R18	19.8	20.1	20.1	Negligible	Negligible
R19	20.4	20.9	21.0	Negligible	Negligible
R20	23.0	24.3	24.3	Negligible	Negligible
R21	23.0	24.3	24.4	Negligible	Negligible
R22	30.6	33.7	33.7	Slight Adverse	Slight Adverse
R23	21.7	22.2	22.3	Negligible	Negligible
R24	29.2	29.4	29.4	Negligible	Negligible
R25	26.3	26.4	26.4	Negligible	Negligible
R26	27.0	27.2	27.2	Negligible	Negligible
R27	21.0	21.1	21.1	Negligible	Negligible
R28	29.2	29.6	29.6	Negligible	Negligible
R29	27.7	28.0	28.1	Negligible	Negligible
R30	**43.2**	**44.4**	**44.4**	Slight Adverse	Slight Adverse
R31	32.7	32.9	32.9	Negligible	Negligible
Objective	**40**			-	-

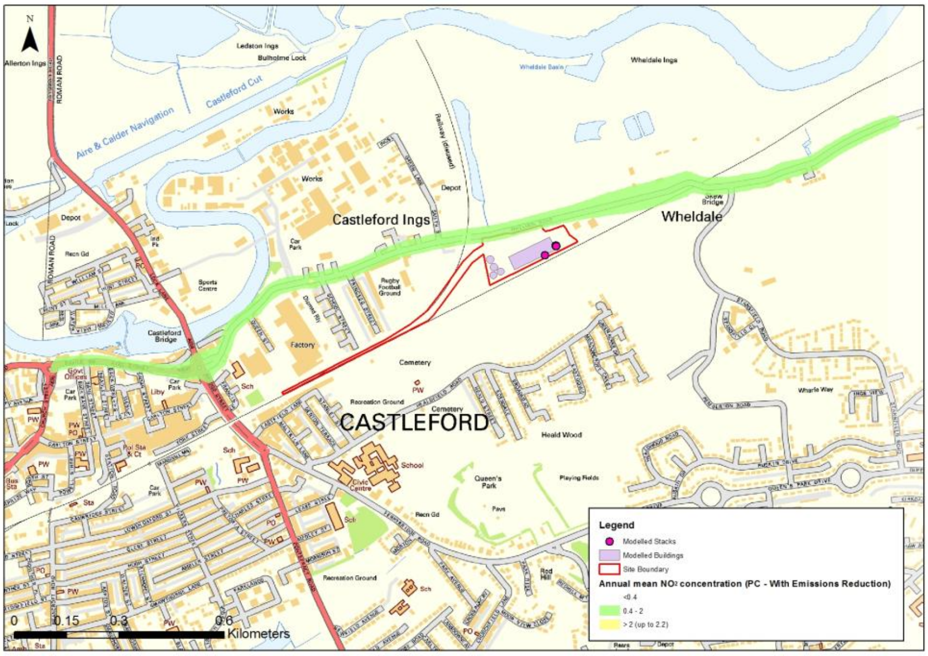
7.5.18 The maximum predicted annual mean and short-term (as the 99.8th percentile) nitrogen dioxide concentrations, for 'ERF stack emissions only', across the gridded area are set out in Table 7.7. The assessment criteria for both annual mean (1% of the objective) and short-term (10% of the objective) nitrogen dioxide concentrations are achieved within the gridded area.

Table 7.7: Maximum Predicted Nitrogen Dioxide Concentrations from ERF Stack Emissions

Pollutant	Averaging period	Maximum Concentration (Process Contribution)		AQO/EAL ($\mu g/m^3$)
		($\mu g/m^3$)	% of AQO	
NO_2	Annual mean	0.2	0.4	40
	1-hour mean (99.8 percentile)	1.7	0.9	200

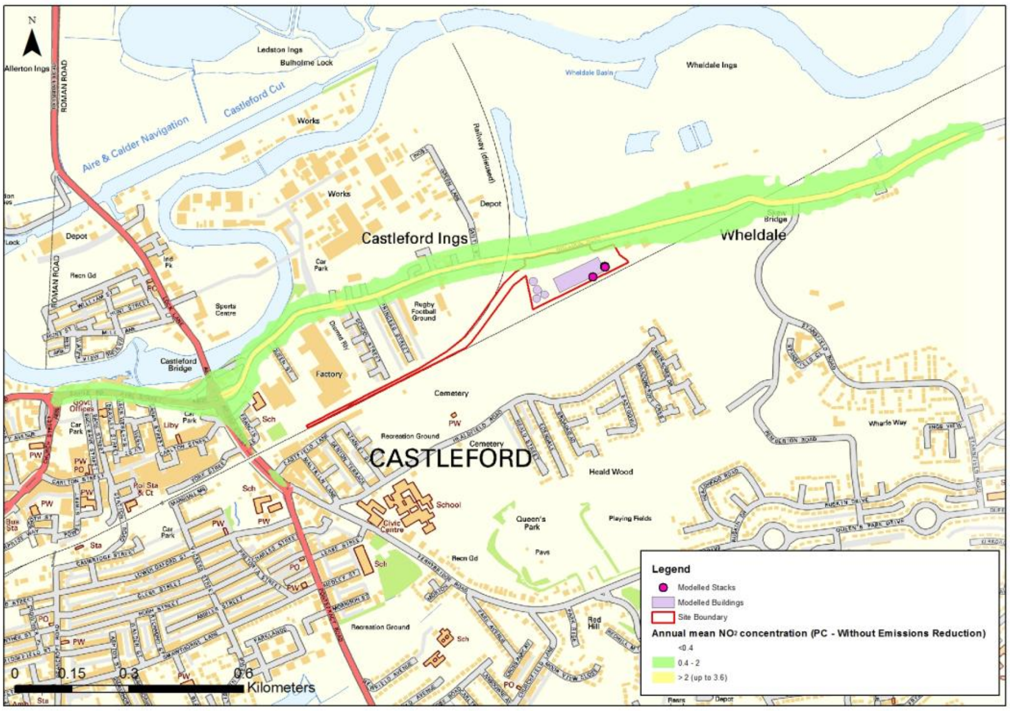
7.5.19 To assess the total combined effect (from traffic and ERF stack emissions) of the development on annual mean nitrogen dioxide concentrations, contour plots of concentrations relating to traffic emissions, with and without emissions reduction, plus ERF stack emissions have been produced (shown in Figures 7.5.2 and 7.5.3 respectively). The isopleths highlight the impacts of road traffic and are not significantly driven by the ERF emissions. Overall, the main effects are focused along Wheldon Road where a medium increase (2 – 4 $\mu g/m^3$) in concentrations is predicted, associated principally with the increase in heavy good vehicles (HGVs). In the AQMA, the maximum effect is of a small increase (0.4 – 2 $\mu g/m^3$) in concentrations where there is relevant exposure, also due principally to the increase in HGVs. The same conclusions, regarding the level of significant effects, can be drawn as for the specified receptor results.

Figure 1: Annual Mean Nitrogen Dioxide Concentration – Effect (traffic and ERF stack emissions) – With Emissions Reduction ($\mu g/m^3$) [a]



For the ERF stack emissions, grid based on worst case meteorological year (2010)

Figure 2: Annual Mean Nitrogen Dioxide Concentration – Effect (traffic and ERF stack emissions) – Without Emissions Reduction (µg/m^3) [a]



For the ERF stack emissions, grid based on worst case meteorological year (2010)

Particulate Matter (PM_{10} and $PM_{2.5}$)

7.5.20 Predicted annual mean concentrations of PM_{10} and $PM_{2.5}$ at specified receptors, as well as days with PM_{10} greater than 50 µg/m^3, are set out in Tables 7.8 to Table 7.10, for both the "Without Scheme" and "With Scheme" scenarios. For the "With Scheme" scenario, results are presented for 'traffic only' and for 'traffic and ERF stack emissions'. The tables also describe the effects at each receptor using the impact descriptors given in Technical Appendix 7.5.

7.5.21 In terms of PM_{10} and $PM_{2.5}$, no exceedences of the objectives are predicted and all of the effects are negligible.

Table 7.8: Predicted Annual Mean PM_{10} Impacts in 2015 (μg/m^3)

Receptor	Without Scheme	Annual Mean Concentration		Impact Descriptor	
		With Scheme			
		(Traffic only)	(Traffic and ERF stacks)	(Traffic only)	(Traffic and ERF stacks)
R1	16.1	16.1	16.1	Negligible	Negligible
R2	16.2	16.2	16.2	Negligible	Negligible
R3	16.9	16.9	16.9	Negligible	Negligible
R4	15.7	15.7	15.7	Negligible	Negligible
R5	16.9	16.9	16.9	Negligible	Negligible
R6	16.9	16.9	16.9	Negligible	Negligible
R7	16.3	16.3	16.3	Negligible	Negligible
R8	16.3	16.3	16.3	Negligible	Negligible
R9	15.7	15.7	15.7	Negligible	Negligible
R10	16.9	16.9	17.0	Negligible	Negligible
R11	16.3	16.3	16.3	Negligible	Negligible
R12	15.1	15.1	15.1	Negligible	Negligible
R13	16.3	16.3	16.3	Negligible	Negligible
R14	16.4	16.4	16.4	Negligible	Negligible
R15	16.4	16.4	16.4	Negligible	Negligible
R16	16.4	16.4	16.4	Negligible	Negligible
R17	16.3	16.3	16.3	Negligible	Negligible
R18	15.2	15.3	15.3	Negligible	Negligible
R19	15.4	15.4	15.4	Negligible	Negligible
R20	15.8	15.9	15.9	Negligible	Negligible
R21	15.8	15.9	15.9	Negligible	Negligible
R22	17.3	17.5	17.5	Negligible	Negligible
R23	15.6	15.6	15.6	Negligible	Negligible
R24	17.5	17.5	17.5	Negligible	Negligible
R25	16.9	16.9	16.9	Negligible	Negligible
R26	17.0	17.0	17.0	Negligible	Negligible
R27	16.8	16.8	16.8	Negligible	Negligible
R28	18.1	18.2	18.2	Negligible	Negligible
R29	17.9	17.9	17.9	Negligible	Negligible
R30	20.4	20.4	20.4	Negligible	Negligible
R31	17.9	17.9	17.9	Negligible	Negligible
Objective	**40**			-	-

[a] The numbers of days with PM_{10} concentrations greater than 50 μg/m^3 have been estimated from the relationship with the annual mean concentration described in LAQM.TG(09) (Defra, 2009).

Table 7.9: Predicted PM_{10} Impacts in 2015 ($\mu g/m^3$)

Receptor	Without Scheme	Estimated Number of Days When PM_{10} Concentrations > 50 $\mu g/m^3$		Impact Descriptor	
		With Scheme			
		(Traffic only)	(Traffic and ERF stacks)	(Traffic only)	(Traffic and ERF stacks)
R1	<1	<1	<1	Negligible	Negligible
R2	<1	<1	<1	Negligible	Negligible
R3	1	1	1	Negligible	Negligible
R4	<1	<1	<1	Negligible	Negligible
R5	1	1	1	Negligible	Negligible
R6	1	1	1	Negligible	Negligible
R7	<1	<1	<1	Negligible	Negligible
R8	<1	<1	<1	Negligible	Negligible
R9	<1	<1	<1	Negligible	Negligible
R10	1	1	1	Negligible	Negligible
R11	<1	<1	<1	Negligible	Negligible
R12	<1	<1	<1	Negligible	Negligible
R13	<1	<1	<1	Negligible	Negligible
R14	<1	<1	<1	Negligible	Negligible
R15	<1	<1	<1	Negligible	Negligible
R16	<1	<1	<1	Negligible	Negligible
R17	<1	<1	<1	Negligible	Negligible
R18	<1	<1	<1	Negligible	Negligible
R19	<1	<1	<1	Negligible	Negligible
R20	<1	<1	<1	Negligible	Negligible
R21	<1	<1	<1	Negligible	Negligible
R22	1	1	1	Negligible	Negligible
R23	<1	<1	<1	Negligible	Negligible
R24	1	1	1	Negligible	Negligible
R25	1	1	1	Negligible	Negligible
R26	1	1	1	Negligible	Negligible
R27	1	1	1	Negligible	Negligible
R28	2	2	2	Negligible	Negligible
R29	1	1	1	Negligible	Negligible
R30	4	4	4	Negligible	Negligible
R31	1	1	1	Negligible	Negligible
Objective	**40**			-	-

Table 7.10: Predicted Annual Mean $PM_{2.5}$ Impacts in 2015 ($\mu g/m^3$)

Receptor	Without Scheme	Annual Mean Concentration With Scheme		Impact Descriptor	
		(Traffic only)	(Traffic and ERF stacks)	(Traffic only)	(Traffic and ERF stacks)
R1	10.5	9.7	9.7	Negligible	Negligible
R2	10.5	9.8	9.8	Negligible	Negligible
R3	11.4	9.5	9.5	Negligible	Negligible
R4	10.2	9.3	9.3	Negligible	Negligible
R5	11.4	9.5	9.5	Negligible	Negligible
R6	11.4	9.4	9.5	Negligible	Negligible
R7	10.6	9.6	9.6	Negligible	Negligible
R8	10.6	9.6	9.6	Negligible	Negligible
R9	10.2	9.3	9.3	Negligible	Negligible
R10	11.5	9.5	9.6	Negligible	Negligible
R11	11.0	9.6	9.6	Negligible	Negligible
R12	10.1	8.9	8.9	Negligible	Negligible
R13	11.0	9.6	9.6	Negligible	Negligible
R14	11.1	9.7	9.7	Negligible	Negligible
R15	11.1	9.7	9.7	Negligible	Negligible
R16	11.1	9.7	9.7	Negligible	Negligible
R17	11.0	9.6	9.6	Negligible	Negligible
R18	10.2	9.0	9.0	Negligible	Negligible
R19	10.3	9.1	9.1	Negligible	Negligible
R20	10.6	9.6	9.6	Negligible	Negligible
R21	10.6	9.6	9.7	Negligible	Negligible
R22	11.5	11.1	11.1	Negligible	Negligible
R23	10.4	9.3	9.3	Negligible	Negligible
R24	11.8	10.7	10.7	Negligible	Negligible
R25	11.4	10.2	10.2	Negligible	Negligible
R26	11.5	10.3	10.3	Negligible	Negligible
R27	10.7	9.9	9.9	Negligible	Negligible
R28	12.1	10.9	10.9	Negligible	Negligible
R29	11.9	10.6	10.6	Negligible	Negligible
R30	13.5	13.2	13.2	Negligible	Negligible
R31	12.0	11.2	11.2	Negligible	Negligible
Objective	**25**			-	-

[a] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 $\mu g/m^3$ is to be met by 2015.

7.5.22 The maximum predicted annual mean concentrations for PM_{10} and $PM_{2.5}$ and the short-term (as the 90.4th percentile) PM_{10} concentration for 'ERF stack emissions only', across the gridded area are set out in Table 7.11. The results show that the modelling does not predict any exceedences of the AQOs and the effects are insignificant.

Table 7.11: Maximum Predicted PM_{10} and $PM_{2.5}$ Concentrations from ERF Stack Emissions

Pollutant	Averaging period	Maximum Concentration (Process Contribution) (μg/m³)		AQO/EAL (μg/m³)
		(μg/m³)	% of AQO	
PM_{10}	Annual mean	0.1	0.1	40
	24-hour mean (90.4 percentile)	0.2	0.3	50
$PM_{2.5}$	Annual mean	0.05	0.2	25

<u>Sulphur Dioxide, Hydrogen Fluoride, HCl, TOC and Carbon Monoxide (ERF stack emissions only)</u>

7.5.23 Table 7.12 presents the predicted maximum ground-level concentrations as a result of the emissions from the ERF stacks. The maximum concentrations for these pollutants do not necessarily occur at an existing receptor where there is relevant exposure. For all of the pollutants the process contributions are below the Environment Agency's screening criteria, and any effects are thus insignificant.

Table 7.12: Maximum Predicted Concentrations from ERF Stacks for Sulphur Dioxide, Hydrogen Fluoride, HCl, TOC and Carbon Monoxide [a]

Pollutant	Averaging period	Maximum Concentration (Process Contribution)		EAL (μg/m³)
		(μg/m³)	% of EAL	
Long-term				
HF	Annual mean	0.005	0.03	16
TOC	Annual mean	0.05	0.9	5
Short-term				
SO_2	15-minute mean (99.9 percentile)	8.9	3.3	266
SO_2	1-hour mean (99.7 percentile)	4.2	1.2	350
SO_2	24-hour mean (99.2 percentile)	2.1	1.7	125
CO	Maximum daily 8-hour running mean	0.01 (mg/m³)	0.1	10 (mg/m³)
HCl	Maximum 1-hour mean	7.1	0.9	75
HF	Maximum 1-hour mean	0.7	0.4	160

[a] Value in bold are > 1% of the long term EAL, or >10% of the short-term EAL.

Trace Metals (ERF stack emissions only)

7.5.24 The assessment of trace metals follows the recommended methodology described by the Environment Agency in its Guidance to Applicants on Impacts for Group 3 Metals Stack Releases, V.3, September 2012. The methodology set out in the EA guidance, describes a three-step approach to the assessment of trace metals in stack emissions, as detailed in the Assessment Criteria section of this chapter.

Step 1: Screening Scenario

7.5.25 Tables 7.13 and 7.14 present the predicted maximum long- and short-term trace metal impact at sensitive receptors[2] for emissions at maximum IED limits. Predicted concentrations have been assessed against the criteria outlined in Technical Appendix 7.2

Table 7.13: Long-term Predicted Maximum Concentrations from ERF Stacks for Trace Metals (Step 1) [a]

Metal	Long-term EAL (µg/m³)	Background Concentration (µg/m³) [b]	Process Contribution (PC)		Predicted Environmental Conc. (PEC)	
			Max. Conc. (µg/m³)	% of EAL	Max. Conc. (µg/m³)	% of EAL
Cadmium	0.005	0.0002	**0.0002**	**3.2**	0.0004	7.9
Thallium	1	n/a	0.0002	0.02	0.0002	0.02
Mercury	0.25	0.00003	0.0002	0.06	0.0002	0.1
Antimony	5	n/a	0.002	0.03	0.002	0.03
Arsenic	0.003	0.0008	**0.002**	**52.6**	0.002	78.6
Chromium (III)[c]	5	0.01	0.001	0.03	0.01	0.2
Chromium (VI)[c]	0.0002	0.0025	**0.0005**	**260.3**	**0.001**	**511.7**
Cobalt	1	n/a	0.002	0.2	0.002	0.2
Copper	10	0.01	0.002	0.02	0.01	0.1
Lead	0.25	0.02	0.002	0.6	0.03	9.8
Manganese	0.15	0.04	**0.002**	**1.1**	0.04	27.1
Nickel	0.02	0.004	**0.002**	**7.9**	0.006	29.9
Vanadium	5	0.002	0.002	0.03	0.004	0.1

[a] Exceedences of the assessment criteria are shown in bold

[b] There are no measured background concentrations for Thallium, Antimony and Cobalt.

[2] For the short-term EAL the maximum concentration across the gridded area has been used.

Assessment has been made against the Process Contribution only

[c] The predicted and background concentrations are apportioned 80% Cr (III), 20% CR (VI) in accordance with the EA's Interim Guidance Note for Metals (Environment Agency, 2012)

Table 7.14: Short-term Predicted Maximum Concentrations from ERF Stacks for Trace Metals (Step 1) [a]

Metal	Short-term EAL (µg/m^3)	Background Concentration (µg/m^3) [b]	Process Contribution (PC)		Predicted Environmental Conc. (PEC)	
			Max. Conc. (µg/m^3)	% of EAL	Max. Conc. (µg/m^3)	% of EAL
Cadmium	n/a					
Thallium	30	n/a	0.04	0.1	n/a	
Mercury	7.5	0.00007	0.04	0.5	0.04	0.5
Antimony	150	n/a	0.4	0.2	n/a	
Arsenic	n/a					
Chromium (III) [c]	150	0.02	0.4	0.2	0.4	0.3
Chromium (VI) [c]	15	0.005	0.1	0.8	0.1	0.8
Cobalt	30	n/a	0.4	1.2	n/a	
Copper	200	0.02	0.4	0.2	0.4	0.2
Lead	n/a					
Manganese	1500	0.08	0.4	0.02	0.5	0.03
Nickel	n/a					
Vanadium	1	0.005	0.4	**36.1**	0.4	36.6

[a] There are no short-term EALs for Cadmium, Arsenic or Lead

[b] There are no measured background concentrations for Thallium, Antimony and Cobalt. Assessment has been made against the Process Contribution only

[c] The predicted and background concentrations are apportioned 80% Cr (III), 20% CR (VI) in accordance with the EA's Interim Guidance Note for Metals (Environment Agency, 2012)

7.5.26 On the basis of the Step 1 screening, further assessment is required for long-term concentrations of cadmium, arsenic, chromium (VI), manganese and nickel and short-term concentrations of vanadium. The impacts from all other trace metals, for long-term and short-term concentrations, are considered to be negligible.

Step 2: Worst-Case Scenario Based On Currently Operating Plant

7.5.27 Table 7.15 presents the predicted maximum long-term cadmium, arsenic, chromium (VI), manganese and nickel impacts at sensitive receptors for emissions at 1/3rd of the maximum IED limit for group I metal cadmium (33.3% of the ELV) and 1/9th of the maximum IED limit (11% of the ELV) for the Group III metals. It also presents the predicted maximum short-term vanadium impact for emissions at 1/9th of the maximum IED limit for Group III metals. Predicted concentrations have been assessed against the criteria outlined in Technical Appendix 7.2.

Table 7.15: Long-term Predicted Maximum Concentrations from ERF Stacks for Cadmium, Arsenic, Chromium (VI), Manganese and Nickel (Step 2)

Metal	EAL ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Maximum PC (Step 2) ($\mu g/m^3$)	PC (% of EAL)	PEC	PEC (% of EAL)
Long-term EAL						
Cd	0.005	0.0002	0.00005	**1.1**	0.0003	5.8
As	0.003	0.0008	0.0002	**5.8**	0.001	31.9
Cr (VI)	0.0002	0.0005	0.00004	**17.5**	0.0005	**269.0**
Mn	0.15	0.04	0.0002	0.1	0.04	26.2
Ni	0.02	0.004	0.0002	0.9	0.005	22.9
Short-term EAL						
Vd	1	0.0048	0.04	4.0	0.05	4.5

7.5.28 On the basis of the Step 2 screening, further assessment is required for long-term cadmium, arsenic and chromium (VI) only. The impact from long-term emissions of manganese and nickel are considered to be negligible.

Step 3: Typical Operational Emissions

7.5.29 The Environment Agency's group III metals guidance includes a summary of emissions monitoring data from 20 municipal waste incinerators, which shows the maximum and minimum emissions concentrations of 10 group III metals, including arsenic and chromium. The minimum and maximum emissions concentrations and fractions for each metal, obtained from the EA guidance note, are presented in Table 7.16.

Table 7.16: Measured Concentrations and Group III Fractions of Chromium at 20 Municipal Waste Incinerators between 2007 and 2009

Pollutant	Concentration (mg/m^3)		Fraction of Group III (%)	
	Minimum	Maximum	Minimum	Maximum
Arsenic	0.0003	0.003	0.06	0.6
Total Chromium	0.0004	0.0521	0.08	10.42

7.5.30 The guidance note also includes the effective Cr(VI) concentration for a range of municipal waste incinerators, based on stack measurements for total chromium and measurements of the proportion of Cr(VI) to total chromium in Air Pollution Control residues collected at the same plant. Emissions concentrations have been provided for the minimum, mean and maximum measured concentrations.

7.5.31 The EA guidance does not provide information on emission concentrations of group I and II metals, including cadmium. Research undertaken by ERM (ERM, 2011) suggest minimum and maximum emission concentrations of 0.0000006 g/tonne of waste processed and 0.000021 g/tonne of waste processed for cadmium from ERFs, which have been used for this assessment.

7.5.32 Emission concentrations for each scenario for each metal have been converted to an emission rate based on the ERF operation parameters and model results presented in Table 7.17. Predicted concentrations have been assessed against the criteria outlined in paragraph 7.3.4.

Table 7.17: Predicted Long-term Concentrations from ERF Stacks for Cadmium, Arsenic and Chromium (VI) (Step 3)

Metal	Emission	Long-term EAL (μg/m^3)	Bkgd Conc. (μg/m^3) b	Process Contribution (PC)		Predicted Environmental Conc. (PEC)	
				Max. Conc. (μg/m^3)	% of EAL	Max. Conc. (μg/m^3)	% of EAL
As	Min.	0.003	0.0008	0.000001	0.03	0.0008	26.1
	Mean			0.000002	0.1	0.0008	26.1
	Max.			0.000009	0.3	0.0008	26.1
Cr (VI)	Min.	0.0002	0.0005	0.00000001	0.004	0.0005	**251.5**
	Mean			0.0000001	0.1	0.0005	**251.1**
	Max.			0.0000004	0.2	0.0005	**251.5**
Cd	Min.	0.005	0.0002	0.00000004	0.00001	0.0002	4.7
	Max.			0.0000001	0.0003	0.0002	4.7

7.5.33 The final predicted maximum (worst-case) ground-level cadmium, arsenic and chromium (VI) PCs are less than 1% of the long-term EAL. The final predicted maximum (worst-case) ground-level cadmium and arsenic PEC is less than 100% of the long-term EAL. The effects from long-term emissions of arsenic are therefore considered to be negligible. The final predicted maximum ground-level chromium (VI) PEC is 251.5% of the long-term EAL. This is predominantly due to the effect of background chromium (VI), which represents 251.4% of the EAL[3]. The process contribution alone represents only 0.2% of the long-term EAL of 0.0002 μg/m^3 (and 0.1% of the background concentration). This is based on the

[3] The background metal concentrations used in the assessment are an average of four monitoring sites, including Sheffield Centre, Sheffield Brinsworth, Scunthorpe Town and Scunthorpe Low Santon. Background chromium concentrations at the Sheffield Brinsworth monitoring site are much higher (by an order of magnitude) than the other sites.

assumption that chromium (VI) makes up 20% of total background chromium concentrations. There is currently no evidence to refine this assumption.

7.5.34 The Step 3 assessment of chromium (VI) based on EA monitoring at municipal waste incinerators is a very worst-case assumption when applied to the pyrolysis process, for a number of reasons. Firstly, the autoclave process, and subsequent materials recovery process, will ensure that a large proportion of the metal component in the MSW processed at the proposed ERF facility will be removed from the feedstock that fuels the pyrolyser. The autoclave and material recovery processes are carried out to ensure that the pyrolysis feedstock has a minimal inorganic component, as this component cannot be processed into syngas by the pyrolyser. This component therefore ends up as solid waste residue, as it is beneficial to ensure that the pyrolysis feedstock is as high in organic material and low in inorganic material as possible.

7.5.35 Overall, it is judged that the maximum ground-level process contribution of chromium (VI) will be substantially lower in reality than the 0.2% based on municipal waste incinerator emissions, due to a lower metal content in the feedstock, and differences between the pyrolysis and incineration processes. It is therefore considered that all emissions and resultant impacts arising from metals from the proposed development are negligible.

Dioxins and Furans (ERF stack emissions only)

7.5.36 The predicted maximum ground-level dioxin and furan concentrations as a result of the emissions from the ERF stacks at identified sensitive receptor locations is 0.3 fg/m^3. This predicted concentration is well below the WHO indicator concentration (300 fg/m^3) above which it would be considered necessary to identify and control emission sources. The average background PCDD/Fs concentration at the nearest monitoring station, located in Manchester, is 27.3 fg/m^3. The process contribution is less than 1.2% of the background concentration.

7.5.37 There are no assessment criteria for dioxins and furans. When compared with the average background concentration measured in Manchester, the impact of the proposed ERF is considered to be negligible.

Uncertainty in Road Traffic Modelling Predictions

7.5.38 There are many components that contribute to the uncertainty of modelling predictions. There are uncertainties with the models as there are required to simplify real-world conditions into a series of algorithms. The roads model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Technical Appendix 7.2). The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment. Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2011) concentrations.

7.5.39 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the roads model cannot be verified in the future, and it is necessary to rely on a series of projections as to what will happen to traffic volumes, background pollutant concentrations, and vehicle emissions. Recently however, a disparity between the road transport emission projections and measured annual mean concentrations of nitrogen oxides and nitrogen dioxide has been identified by Defra (Carslaw et al., 2011). This applies across the UK, although the effect appears to be greatest in inner London; there is also considerable inter-site variation. Whilst the emission projections suggest that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15 – 25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase. This pattern is mirrored in the monitoring data assembled for this study.

7.5.40 The precise reason for this disparity is not known, but is thought to be related to the actual on-road performance of diesel vehicles when compared to the calculations based on the Euro standards. It may therefore be expected that nitrogen oxides and nitrogen dioxide concentrations will not fall as quickly in future years as the current projections indicate. However, at this stage, there is no robust evidence upon which to carry out any revised predictions.

7.5.41 The implications for this assessment are that the absolute nitrogen dioxide concentrations predicted in 2015 may be higher than shown, when based on the official emissions reduction forecasts. To account for this uncertainty in the projections, a sensitivity test has been conducted assuming that the future (2015) road traffic emissions per vehicle are unchanged from 2011 values. The predictions within this sensitivity test are likely to be over-pessimistic, as new vehicles meeting more stringent standards will be on the road from 2013/14 (Carslaw et al., 2011).

7.5.42 The assessment of road traffic effects assumes all material being transported to/from the ERF will go via road. The proposed train terminal platform allows for the delivery of the material via rail, which will reduce the number of HGVs on the road and thereby reduce the predicted road effects. At this stage, the proportion of material being transported via rail and road is not known, therefore the road traffic effects will have been over-estimated.

Significance of Operational Air Quality Effects on Human Health

7.5.43 The operational air quality effects are judged to be minor adverse. This professional judgement is made in accordance with the methodology set out in Technical Appendix 7.4, taking into account the factors set out in Technical Appendix 7.5 and the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as currently projected. The latter has been addressed by giving consideration to both sets of modelled results for nitrogen dioxide; those with and without reductions in traffic emissions. It is to be expected that concentrations will fall in the range between the two sets of results.

7.5.44 More specifically, the judgement that the air quality effects will be minor adverse takes account of the assessment that whilst concentrations will be below the objective at most receptors, the scheme results in a small to medium increases in annual mean nitrogen dioxide concentrations at two receptors, which result in a slight adverse effects at these receptors. The effect is related principally to the change in road traffic flows. The road traffic effects will be less than predicted, due to this part of the assessment assuming that all material will be transported via road. In reality some material will be transported via rail. The mode of transport by which material will be transported and by what proportions is currently unknown.

Ecological receptors

Ambient Concentrations

7.5.45 Table 7.18 presents the predicted maximum concentrations for nitrogen oxides, sulphur dioxide and hydrogen fluoride as a result of the emissions from the ERF stacks at the Fairburn and Newton Ings SSSI/LNR.

7.5.46 For nitrogen oxides, sulphur dioxide and hydrogen fluoride, the modelling does not predict any exceedences of the relevant 1% or 10% screening criteria. The potential for significant effects from of these pollutants can thus be discounted.

Table 7.18: Maximum Predicted Concentrations From ERF Stacks for Nitrogen Oxides (NOx), Sulphur Dioxide and Hydrogen Fluoride at Fairburn and Newton Ings SSSI/LNR [a]

Pollutant	Averaging period	Maximum Concentration (Process Contribution)		Critical Level/EAL ($\mu g/m^3$)
		($\mu g/m^3$)	% of CL/EAL	
NOx	Annual mean	0.1	0.4	30
	Daily Mean	1.1	1.4	75
SO_2	Annual mean	0.1	0.5	20
HF	Daily Mean	0.002	0.04	<5
	Weekly Mean	0.002	0.4	<0.5

a Value in bold are > 1% of the critical level, or >10% of the short-term EAL.

Deposition Fluxes

7.5.47 Table 7.19 presents the maximum predicted nitrogen and acid deposition rates to the Fairburn and Newton Ings SSSI and LNR, as a result of the emissions from the ERF stacks.

Table 7.19 Maximum Nitrogen and Acid Deposition Rates From ERF Stacks on Fairburn and Newton Ings SSSI/ LNR [a]

Criteria		Maximum Concentration (Process Contribution)		Minimum Critical Load (kg or keq/ha/yr)
		kg or keq/ha/yr	% of CL	
Nitrogen Nutrient Deposition (kgN/ha/yr)		0.01	0.1	10
Acid Deposition (keq/ha/yr)	Nitrogen	0.001	0.1	1.033
	Total	0.006	0.5	1.033

[a] Value in bold are > 1% of the critical load

7.5.48 The background nutrient nitrogen deposition flux without the Scheme will exceed the lower-bound critical load. The ERF stack emissions will contribute a maximum of 0.01 kg/ha/yr to nutrient nitrogen deposition, 0.001 keq/ha/yr to nitrogen acid deposition and 0.006 keq/ha/yr to total acid deposition in the SSSI. This is less than 1% of the lower-bound critical loads and therefore the potential for significant effects from nitrogen and acid deposition can be discounted.

Significance of Operational Air Quality Effects on Ecological Health

7.5.49 In summary, the potential effect of the ERF stack emissions on the Fairburn and Newton Ings SSSI are insignificant.

7.6 MITIGATION

Construction

7.6.1 Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby residential properties.

7.6.2 The site has been identified as a Medium Risk. Comprehensive guidance has been published by IAQM on mitigation measures to control dust and air emissions (IAQM, 2012a), and on monitoring during demolition and construction (IAQM, 2012b). This reflects best practice experience, and has been used to draw up a generic set of mitigation measures. These measures are described in Appendix 7.7. They will not all be relevant to the works being carried out, but should be used, as appropriate, to specify the measures that should be incorporated into the specification for the works. Mitigation should be straightforward, as most of the necessary measures are routinely employed as 'good practice' on construction sites.

7.6.3 The mitigation measures should to be written into a dust management plan (DMP). For major sites The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring.

7.6.4 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

Operation

<u>Road Traffic</u>

7.6.5 Whilst the assessment has demonstrated that the scheme would not cause any exceedences of the nitrogen dioxide air quality objective in areas where they are not currently exceeded, it has shown that the effect of the proposed development would be slight adverse at a small number of receptors within the AQMA declared within Castleford town centre. This slight adverse impacts is anticipated with or without the proposed ERF scheme, given the approved network rail depot and the anticipated growth within the local area, as detailed within the Castleford Growth Delivery Plan, which show the site to be allocated for employment led development.

7.6.6 Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation. There will also be a contribution through the Air Quality Action Plan developed by WDC.

7.6.7 Specific mitigation measures to improve emissions from the vehicles serving the site are still being developed. These are likely to include the provision of electric-car charging points on-site, the use of bio-gas produced at the ERF facility to provide fuel for some of the development HGVs. The transport of material via rail will reduce the effects from emissions from HGVs transporting material to the ERF, however it is not possible to quantify this effect at this stage.

7.7 RESIDUAL EFFECTS

Construction

7.7.1 Table 7.20 provides an overall summary table of the residual effects of dust and PM_{10} during construction with mitigation in place.

Table 7.20: Summary Significance Table With Mitigation

Source	Dust soiling effects	PM_{10} effects
Earthworks	Negligible	Negligible
Construction	Negligible	Negligible
Trackout	Negligible	Negligible
Overall significance	**Negligible**	

7.7.2 Overall there is judged to be a negligible risk of dust effects during the construction period.

Operation

Rail

7.7.3 The residual effects of emissions from rail are the same as those concluded in Section 7.5.

Road Traffic

7.7.4 The residual effects of emissions from road and/or ERF stacks on human and ecological health, for most pollutants, are the same as those concluded in Section 7.5.

7.7.5 With respect to nitrogen dioxide, the increase in HGVs is the principal contributor to the effects. Mitigation of these nitrogen dioxide effects is being delivered through the implementation of more stringent European standards on emissions from motor vehicles and through the local air quality action plan measures being implemented by WDC. In addition, site-specific measures will be implemented. The transport of material via rail will reduce the effects of emissions from HGVs transporting material to the ERF, however it is not possible to quantify this effect at this stage. The residual effects on human health are, however, considered to remain as minor adverse.

7.8 SUMMARY

7.8.1 The air quality effects associated with the construction and operation of the proposed ERF facility at Wheldon Road have been assessed. Existing conditions within the study area show poor air quality, with concentrations of nitrogen dioxide exceeding the annual mean objective within Castleford town centre, located less than 1 km to the west of the Application Site. An AQMA has been declared for this area.

7.8.2 The operational impacts of increased traffic emissions arising from the additional traffic on local roads, due to the development, and emissions from the ERF stacks have been assessed. Concentrations have been modelled for worst-case human receptors, representing existing properties where impacts are expected to be greatest, as well as for ecological receptors on the Fairburn and Newton Ings SSSI. In the case of nitrogen dioxide, the modelling has been carried out assuming both a) vehicle emissions decrease (using 'official' emission factors) and b) do not decrease in future years. This is to allow for current uncertainty over emission factors for nitrogen oxides that has been identified by Defra (Carslaw et al., 2011). A qualitative assessment of the effects of emissions from trains using the proposed train terminal platform has also been made.

7.8.3 It is concluded that concentrations of PM_{10} and $PM_{2.5}$ remain below the objectives at all existing receptors in 2015, whether the scheme is developed or not. This conclusion is consistent with the outcomes of the review and assessments prepared by WDC, which show that exceedences of the PM_{10} objective are unlikely at any location. In the case of nitrogen dioxide, the annual mean concentrations are above the objective at one modelled receptor (R30), which is located within the Castleford AQMA, both with or without the scheme, assuming that vehicle emissions do not reduce between 2011 and 2015.

7.8.4 The assessment has assumed the proposed scheme increases HGVs on the local roads by 164 vehicles per day. This leads to an imperceptible increase in concentrations of PM_{10} and $PM_{2.5}$ at all modelled receptors, and the effects are all insignificant. In the case of nitrogen dioxide, there are small increases at most of the modelled receptors, with medium increases at eight receptors. Assuming that vehicle emissions do not reduce between 2011 and 2015 the impacts are small at most receptors, with medium increases at seven receptors, with a large increase at one receptor. With and without a reduction in vehicle emissions over this period, the impacts are slight adverse at between one and two receptors, respectively. In practice, the effects will be less than this since the actual number of HGVs will be less, as some material will be transported via rail.

7.8.5 In the case of sulphur dioxide, total organic carbon (as Benzene), HCl and hydrogen fluoride concentrations, the effects of the ERF stack emissions are below the screening criteria, and the effects are therefore judged to be insignificant.

7.8.6 For most trace metals, the effects of the ERF stack emissions are below the screening criteria and considered to be insignificant. The annual mean background concentration for chromium (VI) is already well above (251% of) the Environment Agency's Environmental Assessment Level, but the contribution from the proposed ERF facility with typical emissions is negligible at sensitive receptors and thus insignificant.

7.8.7 The predicted dioxin and furan concentrations arising from the ERF facility are 1.2% of the background concentration and this is considered to be negligible and thus insignificant.

7.8.8 The operational air quality effects of the development on human health are judged to be minor. This takes account of the assessment that whilst concentrations will be below the objective at most receptors, the scheme results in a medium to large increase in annual mean nitrogen dioxide concentrations at a number of receptors and this results in a slight adverse effect at up to two receptors. The effect is related principally to the change in road traffic flows, and not the ERF stack emissions.

7.8.9 Mitigation of the nitrogen dioxide effects is being delivered through the implementation of more stringent European standards on emissions from motor vehicles and through the local air quality action plan measures being implemented by WDC. In addition, site-specific measures will be implemented. The transport of material via rail will reduce the effects from emissions from HGVs transporting material to the ERF, however it is not possible to quantify this effect at this stage. The residual effects on human health are, however, considered to remain as minor adverse.

7.8.10 The effects of the ERF stack emissions of nitrogen oxides, sulphur dioxide and hydrogen fluoride on the SSSI are below the screening criteria, and the impacts are therefore insignificant. The effects of the proposed development on nutrient nitrogen and acid deposition at the SSSI are also below the screening criterion and therefore insignificant.

7.8.11 The construction works have the potential to create dust. During construction a package of mitigation measures should be applied to minimise dust emission. The overall impacts during construction are judged to be insignificant.

Table 7.21: Overall Summary Significance Table

Effects	Receptor Sensitivity	Effect Magnitude	Nature of Effect	Effect Duration	Significance	Mitigation	Residual Effect Magnitude	Residual Effects Significance
Construction Phase								
Construction Dust	Low	Negligible to Medium	Negative, direct	Short-term, temporary	Insignificant	A package of mitigation measures should be implemented to minimise any dust effects at nearby local receptors.	Negligible	Negligible
Operational Phase								
Operation – Human Health	High	Imperceptible to Medium	Negative, direct	Long-term, permanent	Minor Adverse	European standards on motor vehicle emissions, WDC action plan measures and site specific measures	Imperceptible to Medium	Minor Adverse
Operation – Ecological Health	Low	Negligible	Negative, direct	Long-term, permanent	Insignificant	No specific mitigation required.	Negligible	Insignificant

APPENDIX 7.1

ASSESSMENT METHODOLOGY

Sensitive Locations

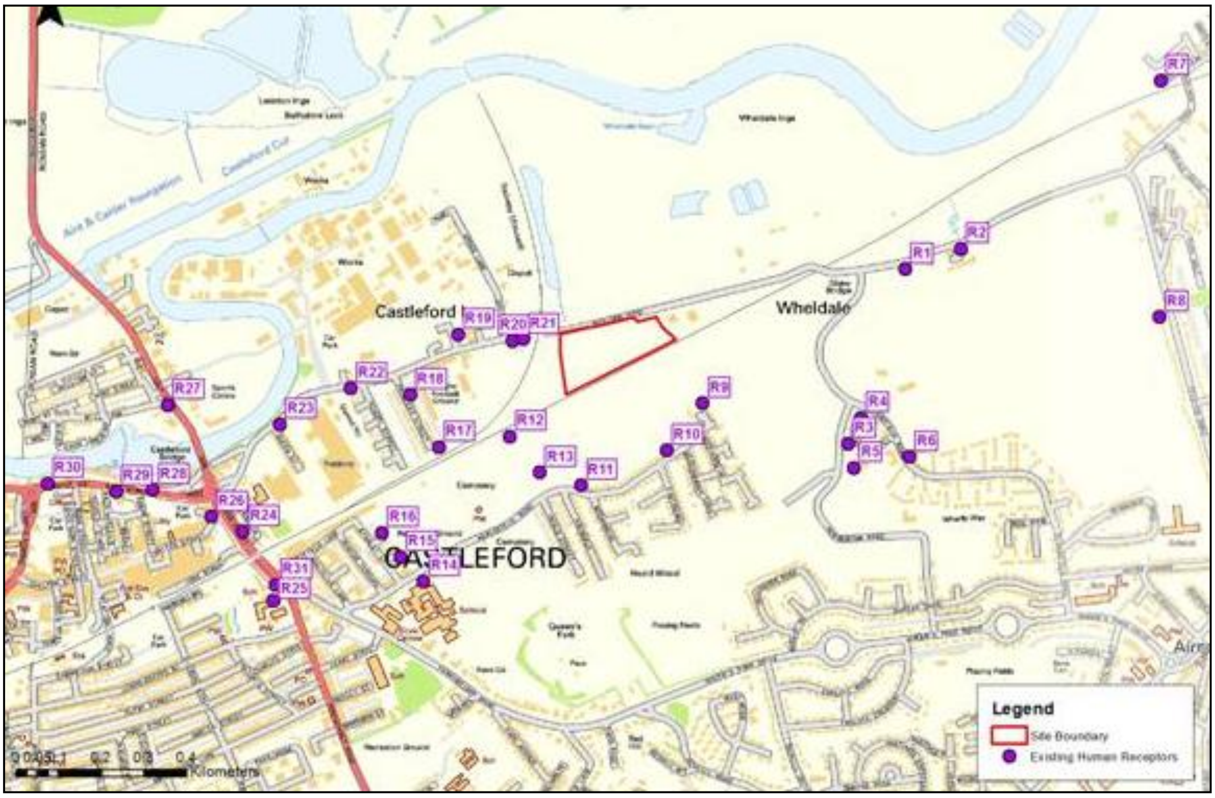
Receptors have been identified to represent worst-case exposure within the sensitive locations identified in Section 7.3 of the ES chapter. When selecting receptors adjacent to roads, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links. When selecting receptors respect to emissions from the ERF stacks, consideration has been given to locations likely to be downwind of stack emissions so as to capture the grounding of emissions from the stack.

Human Health Receptors

The receptors have been located on the façades of the properties closest to the sources. Concentrations have been modelled at specified receptor points at the ground floor (1.5 m) or first floor (4.5 m) (within the centre of Castleford, where flats are located above shops). Thirty-one existing residential properties have been identified as receptors for the assessment.

In addition, concentrations have been modelled at the automatic monitoring site and four diffusion tube monitoring sites located in Castleford, in order to verify the modelled results.

Human Receptor Locations



Description of Existing Human Receptor Locations

Receptor	Description	Floor
Receptor 1	Residential property at Elder Bank House	Ground
Receptor 2	Residential property at 1 Fairview	Ground
Receptor 3	Residential property at 36 Stansfield Close	Ground
Receptor 4	Residential property at Wheldale Court	Ground
Receptor 5	Residential property at 22-29 Stansfield Close	Ground
Receptor 6	Residential property at 41 Foss Walk	Ground
Receptor 7	Residential property at 10 South View	Ground
Receptor 8	Residential property at 323 Fryston Road	Ground
Receptor 9	Residential property at Hilltop Close	Ground
Receptor 10	Residential property at 161 Healdfield Road	Ground
Receptor 11	Residential property at 101 Healdfield Road	Ground
Receptor 12	Residential property at Healdfield Road	Ground
Receptor 13	Residential property at Healdfield Road	Ground
Receptor 14	Castleford High School	Ground
Receptor 15	Residential property at 6 Boston Street	Ground
Receptor 16	Residential property at 7 Lincoln Street	Ground
Receptor 17	Residential property at 62 Princess Street	Ground
Receptor 18	Residential property at 12 Princess Street	Ground
Receptor 19	Residential property at 1 Hepworth Street	Ground
Receptor 20	Residential property at118 Wheldon Street	Ground
Receptor 21	Residential property at 128 Wheldon Street	Ground
Receptor 22	Residential property at 92 Wheldon Street	Ground
Receptor 23	Residential property above 1 Queen Street	First
Receptor 24	Residential property above Gibson Comps	First
Receptor 25	St. Joseph’s School	Ground
Receptor 26	Residential property above Magic Wok	First
Receptor 27	Residential property above One Call Accountants	First
Receptor 28	Residential property above Star Fisheries	First
Receptor 29	Residential property above The Lion	First
Receptor 30	Residential property at 20 Saville Road	Ground
Receptor 31	Residential property at 1 Bridge Street	Ground

A 7.5 x 5 km Cartesian grid centred on the ERF was also modelled to provide further detail, with a grid resolution of 5 m within 100 m of the facility, 10 m within 200 m of the facility and 40 m elsewhere, at a height of 1.5 m to represent ground-level concentrations.

Ecological Receptors

For assessment of the Fairburn and Newton Ings SSSI/LNR, a Cartesian grid covering the area was modelled, with a grid point resolution of 20 m, at a height of 0 m. Concentrations of nitrogen oxides, sulphur dioxide and hydrogen fluoride have been modelled for assessment of effects from the ERF stacks against the critical levels and loads outlined in Section 7.3 of the ES chapter.

Assessment Criteria

The relevant air quality criteria for this assessment are provided in the Table below with further information provided in Section 7.3 of the ES chapter.

Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year
	Annual mean	40 $\mu g/m^3$
Fine Particles (PM_{10})	24-hour mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year
	Annual mean	40 $\mu g/m^3$
Fine Particles ($PM_{2.5}$) [a]	Annual mean	25 $\mu g/m^3$

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it. The EU limit value is the same, but is to be met by 2015.

The objectives for the protection of vegetation and ecosystems are summarised in the Table below, with further information provided in the ES chapter.

Vegetation and Ecosystem Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual mean	30 $\mu g/m^3$
Sulphur Dioxide	Annual mean and winter average	20 $\mu g/m^3$

The critical loads for the ecosystems under consideration in this assessment are provided in the Table below, with further information provided in the ES chapter.

Vegetation and Ecosystem Critical Loads

Habitat [a]	Critical Load	
	Nutrient Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)
Lowland Fens	10 – 30	1.033 – 4.293*
Purple Moor Grass and Rush Pastures	15 – 25	1.033 – 4.293*
Lowland Meadows	20 – 30	1.033 – 5.071*
Fen, Marsh and Swamp	10 – 30	1.033 – 5.071*
Neutral Grassland	20 – 30	1.033 – 5.071*

* Critical loads based on Min CL Max N and Max CL Max N on the APIS website (APIS, 2013).

The table below summarises the AQOs and EALs used to assess the effect of the proposed development. Further details are provided in the ES chapter.

Air Quality Objectives and Environmental Assessment Levels: Protection of Human and Ecological Health

Pollutant	Averaging period	Concentration ($\mu g/m^3$)	Number of periods allowed to exceed per year	AQO	EAL
Human Health					
NO_2	Annual	40	n/a	X	
	1hour	200	18	X	
PM_{10}	Annual	40	n/a	X	
	24 hours	50	35	X	
$PM_{2.5}$	Annual	25	n/a	X	
SO_2	24 hours	125	3	X	
	1 hour	350	24	X	
	15 minutes	266	35	X	
CO	8 hour rolling mean	10 (mg/m^3)	n/a	X	
HF	Annual	16	n/a		X
	1 hour	160	n/a		X
HCl	Annual mean	20			X [b]
	1 hour	750	n/a		X

Benzene	Running annual mean	16.25	n/a	X	
	Annual mean	5 [a]	n/a	X	
Cadmium	Annual	0.005	n/a	X	
Thallium	Annual	1	n/a		X
	1hour	30	n/a		X [b]
Mercury	Annual	0.25	n/a		X
	1hour	7.5	n/a		X
Antimony	Annual	5	n/a		X
	1hour	150	n/a		X
Arsenic	Annual	0.003	n/a		X
Chromium (III)	Annual	5	n/a		X
	1hour	150	n/a		X
Chromium (VI)	Annual	0.0002	n/a		X
	1hour	15	n/a		X [b]
Cobalt	Annual	1	n/a		X
	1hour	30	n/a		X [b]
Copper	Annual	10	n/a		X
	1hour	200	n/a		X
Lead	Annual	0.25	n/a	X	
Manganese	Annual	0.15	n/a		X
	1hour	1500	n/a		X
Nickel	Annual	0.02	n/a	X	
Vanadium	Annual	5	n/a		X
	1hour	1	n/a		X
Ecological Health					
NO_x	Annual mean	30	n/a	X	
	Daily mean	75	n/a		X
SO_2	Annual mean	20	n/a	X	
HF	Daily mean	<5	n/a		X
	Weekly mean	<0.5	n/a		X

[b] TOC assessed against the AQO for benzene.

[b] Long- and short-term EALs for Thallium and Cobalt, the long-term EAL for HCl and the short-term EAL for Chromium (VI) have been calculated from the exposure limits in EH40 (HSE, 2005), and converted to the respective EAL using guidance in H1 (Environment Agency, 2011).

APPENDIX 7.2

MODELLING METHODOLOGY

Background Concentrations

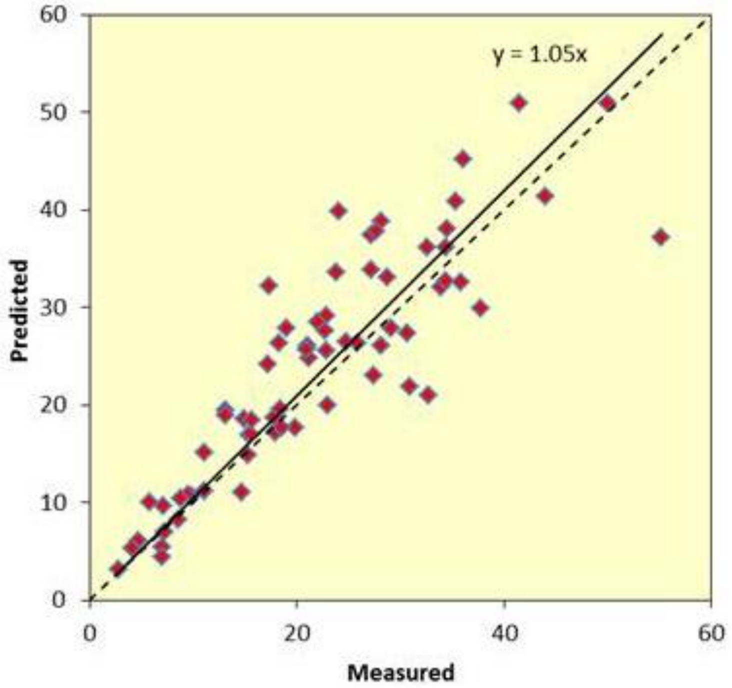
The background concentrations across the study area have been defined using the national pollution maps published by Defra (2012a). These cover the whole country on a 1x1 km grid and are published for each year from 2008 until 2020. The maps include the influence of emissions from a range of different sources; one of which is road traffic. As noted in paragraph 7.4.10 of the ES chapter, there are some concerns that Defra may have over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2008 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2008. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2011, it is assumed that there was no reduction in the road traffic component of backgrounds between 2008[1] and 2011. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2012a). For each grid square, the road traffic component has been held constant at 2008 levels, while 2011 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2012a) publishes to accompany the maps. The result is a set of 'adjusted 2011 background' concentrations.

As an additional step, the background maps have been calibrated against national measurements made as part of the AURN during 2011. The published background maps were calibrated against 2010 monitoring data. 2010 was identified as a 'high pollution' year, as a result the background maps may over predict the local background concentrations. Therefore a comparison between the 2011 annual mean nitrogen dioxide concentration at all background monitoring sites within the AURN and the background mapped concentrations has been carried out. These are shown on the chart overleaf. Based on the 68 sites with more than 75% data capture for 2011 the maps over-predict the background concentrations by 5%, on average. This has been allowed for in production of the calibrated 'adjusted' 2011 background concentrations.

[1] This approach assumes that has been no reduction in emissions per vehicle but also that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. Overall, this discrepancy is unlikely to influence the overall conclusions of the assessment.

Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2011



Two separate sets of 2015 background nitrogen dioxide and nitrogen oxides concentrations have been used for the future-year assessment. The 2015 background ‘without emissions reduction’ has been calculated using the same approach as described for the 2011 data: the road traffic component of background nitrogen oxides has been held constant at 2008 values, while 2015 data are taken for the other components. Nitrogen dioxide has then been calculated using Defra’s background nitrogen dioxide calculator. The 2015 background ‘with emissions reduction’ assumes that Defra’s predicted reductions occur from 2011 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2011 to the unadjusted mapped value for 2015. This ratio has then been applied to the adjusted 2011 value.

For PM_{10} and $PM_{2.5}$, there is no strong evidence that Defra’s predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

Road Traffic Effects

Model Inputs

Predictions have been carried out using the ADMS-Roads dispersion model (v3.1). The model requires the user to provide various input data, including the AADT flow, the proportion of HDVs, road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. Vehicle emissions are calculated within ADMS-roads (v3.1) based on vehicle flow, composition and speed using the same emission factors as published within the EFT, version 4.2.2 (Defra, 2012a)[2]. For nitrogen dioxide future-year concentrations have been predicted once using year-specific emission factors from the EFT and once using emission factors for 2011[3] which is the year for which the model has been verified.

The model has been run using the most recent full year of meteorological data (2011) from the monitoring station located at Church Fenton, which is considered suitable for this area.

AADT flows for Aire Street, Lock Lane, Wheldon Road and Bridge Street have been provided by Pell Frischmann. The proportion of heavy duty vehicles (HDV) of the baseline AADT flows has been based on the DfT data (DfT, 2012). The proportion of HGVs (divided into rigid and articulated) of the development flows have been provided by Pell Frischmann. Speeds have been assumed to be the speed limit for the road, unless at a junction. The traffic data used in this assessment are summarised in the Table below.

Summary of Traffic Data used in the Assessment (AADT)

Road Link	2011		2015 (Without Scheme)		2015 (With Scheme)	
	AADT	%HGV	AADT	%HGV	AADT	%HGV
Aire Street	16,050	5.0	16,476	5.0	16,594	5.6
Lock Lane	13,717	5.2	14,081	5.2	14,092	5.2
Wheldon Road	5,453	5.2	5,597	5.2	5,765	7.4
Bridge Street	15,587	5.2	16,000	5.2	16,037	5.4

Model Verification

In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The verification methodology is described below. It is not practical, nor usual, to verify the ADMS-4 model and because ADMS-5 does not rely on estimated road-vehicle emission factors, the adjustment used for ADMS-Roads cannot be applied to ADMS-5. Predictions made using ADMS-5 have thus not been verified.

AADT flows, and the proportions of HDVs, for Saville Road, Pontefract Road and Church Street have been determined from the interactive web-based map provided by the Department for Transport (DfT, 2012). The 2010 AADT flows were factored forwards to the assessment year of 2011 and 2015 using growth factors derived from the National Transport Model and associated guidance (DfT, 2009), adjusted to local conditions using the TEMPRO System v6.2 (DfT, 2011).

[2] An updated version of the EFT (v5.2c) was issued in January 2013. The road traffic assessment was carried out prior to the release of the latest version of the EFT (August, 2012). Since the model has been verified, reasonable confidence can be had in the predicted concentrations.
[3] i.e. combining current-year emission factors with future-year traffic data.

The AADT data for Ferrybridge Road is based on a short-term manual count carried out during a site visit (on 2nd July). This data was factored to an AADT using the typical diurnal flow profiles published by the Department for Transport (DfT, 2012). Traffic data used in the model verification are presented in the Table below.

AADT Traffic Data used in the Model Verification, 2011

Road Link	AADT	%HDV
Saville Road (west of roundabout)	9,136	2.8
Saville Road (east of roundabout)	16,050	5.0
Church Street	14,726	4.1
Bridge Street	15,587	5.2
Ferrybridge Road	11,658	4.3
Pontefract Road	15,501	3.9

Nitrogen Dioxide

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2011 at the Castleford automatic monitor, and 20 Saville Road, 21 Ferrybridge Road, 17 Ferrybridge Road and 71 Pontefract Road diffusion tube monitoring sites. Concentrations have been modelled at 1.7 m, the height of the monitors.

The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx was calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator available on the Defra LAQM Support website (Defra, 2012a).

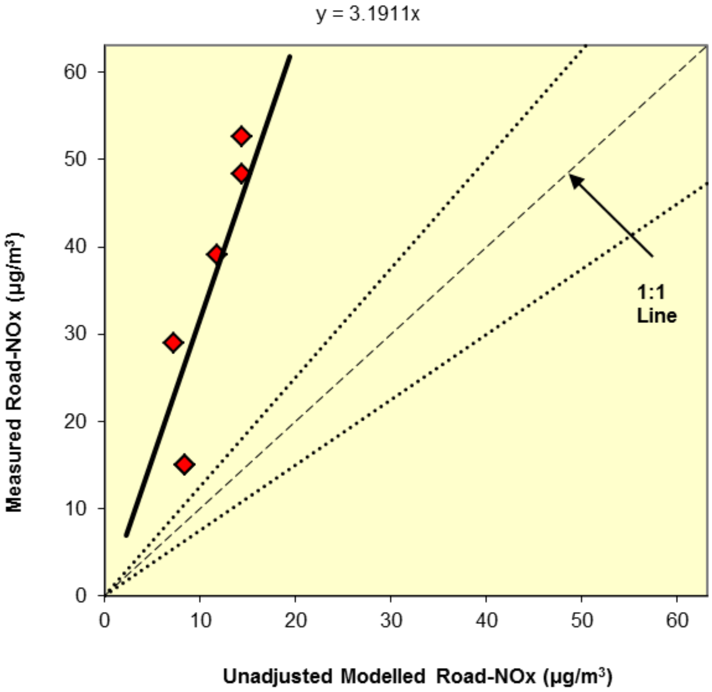
A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero.

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

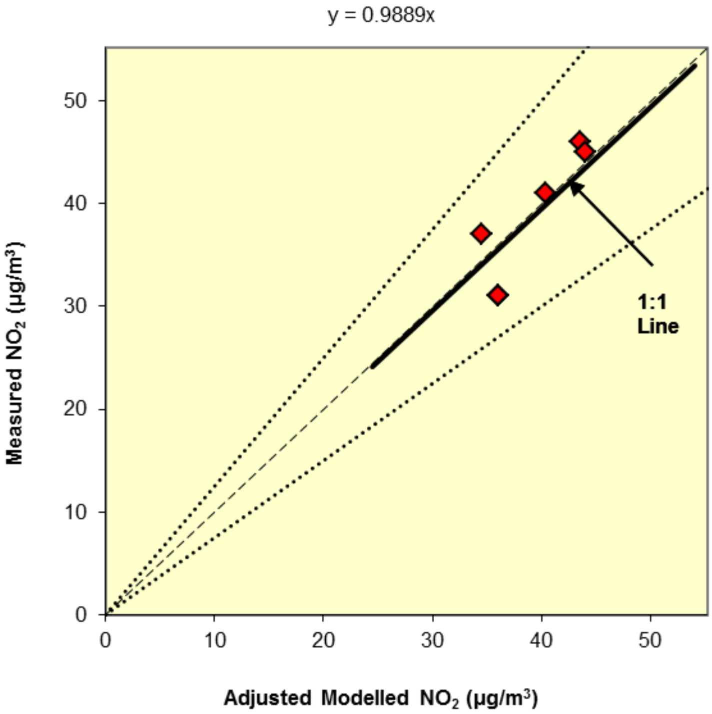
- Primary adjustment factor : 3.191
- Secondary adjustment factor: 0.989

The results imply that the model was under-predicting the road-NOx contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations The dashed lines show ± 25%.

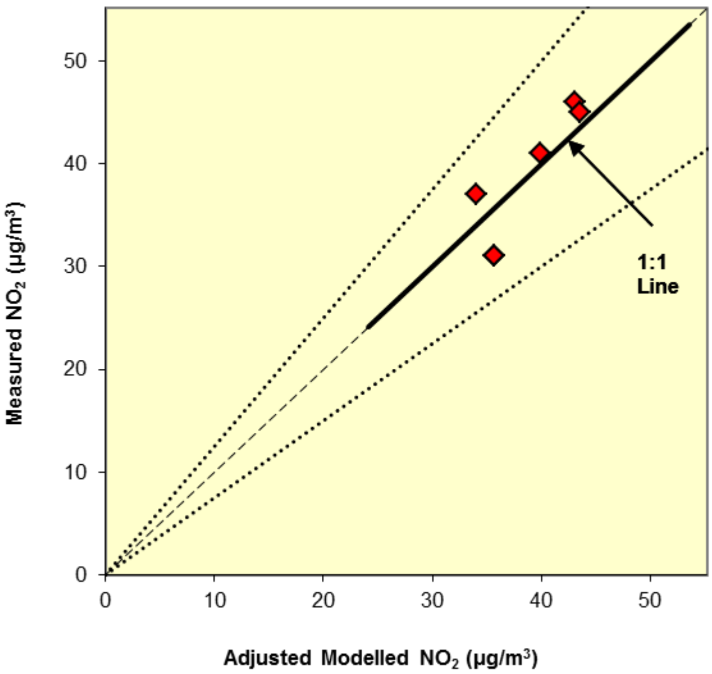


Comparison of Measured Total NO_2 to Primary Adjusted Modelled Total NO_2 Concentrations The dashed lines show ± 25%.



The chart below compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows a 1:1 relationship.

Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations The dashed lines show ± 25%.



<u>PM_{10} and $PM_{2.5}$</u>

The model has been run to predict annual mean road-PM_{10} concentrations during 2011 at the Castleford automatic monitor. A similar process to calculate the road-NOx adjustment factor was followed.

The measured road-PM_{10} and modelled road-PM_{10} concentrations are compared to provide the factor for PM_{10}. The data used to calculate the adjustment factor are provided below:

- Measured PM_{10}: 20 µg/m^3
- 'Measured' road-PM_{10} (measured – background at monitor): 20.0 –17.0 = 3.0 µg/m^3
- Modelled road-PM_{10} = 0.85 µg/m^3
- Road-PM_{10} adjustment factor: 3.0/0.9 = 3.5

There are no nearby $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for $PM_{2.5}$. The model outputs of road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor calculated for road-PM_{10}.

The number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration has been calculated from the adjusted-modelled total annual mean concentration following the relationship advised by (Defra, 2009):

$$A = -18.5 + 0.00145\ B^3 + 206/B$$

where A is the number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration and B is the annual mean PM_{10} concentration. The relationship is only applied to annual mean concentrations greater than 16.5 µg/m^3, below this concentration, the number of 24-hour exceedences is assumed to be zero.

<u>Deposition Calculations</u>

Deposition has not been included within the dispersion model because the principal depositing component of concern is nitrogen dioxide and this is calculated from nitrogen oxides outside of the model. Instead, deposition has been calculated from the predicted ambient concentrations using the deposition velocities set out in the Table below. The velocities are applied simply by multiplying a concentration (µg/m^3) by the velocity (m/s) to predict a deposition flux (µg/m^2/s). Subsequent calculations required to present the data as kg/ha/yr of nitrogen or sulphur and as keq/ha/yr for acidity follow basic chemical and mathematical rules.

Wet deposition has been discounted. Wet deposition of the emitted pollutants this close to the emission source will be restricted to wash-out, or below cloud scavenging. For this to occur, rain droplets must come into contact with the gas molecules before they hit the ground. Falling raindrops displace the air around them, effectively pushing gasses away. The low solubility of nitrogen dioxide means that any scavenging of this gas will be a negligible factor. While wash-out of sulphur dioxide might be more significant, the very low sulphur oxide emission rates mean that discounting wet deposition is highly unlikely to affect

Deposition Velocities Used In Assessment

Pollutant	Deposition Velocity (m/s)	Reference
Nitrogen Dioxide	0.001 m/s	Metcalfe (2001)[4], Hall *et al.,* (2008)[5], Highways Agency, (2007)[6]
Sulphur Dioxide	0.005 m/s	Hall *et al.*, (2008)

ERF Stack Emission Effects

The impacts of emissions from the proposed ERF (pyrolyser and gas engines) have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the art understanding of the dispersion processes within the atmospheric boundary layer.

Worst-case IED emission limits have been assumed for the purposes of the modelling assessment and the plant is assumed to be operating at full load, continually throughout the year. The exhaust temperatures, and exhaust flow rate have been provided by Clean Power Properties Limited. The stack release conditions are set out in the Table below.

Summary of Modelled Stack Parameters

Stack Parameters		Pyrolyser*	Gas Engines (3)
Exit Velocity (m/s)		17.2	26.2
Exhaust Temperature (^oC)		300	385
Stack Internal Diameter (m)		1.2**	1.0
Stack Height Above Building Roof (m)		26.77	26.77
Emission Rate (g/s)	PM_{10}	0.061	-
	HCl	0.061	-
	HF	0.0061	-
	CO	0.31	6.4
	SO_x	0.307	-
	NO_x	0.0615	0.105
	Group I & II Metals	0.00031	-
	Group III Metals	0.0031	-
	Dioxins and Furan	6.2×10^{-10}	-

[4] Metcalfe 2001 Developing the Hull acid rain model: Its validation and implication for policy makers. Environmental Science and Policy, 4, 25-37.
[5] Hall et al (2008) Review of modelling methods of near-field acid deposition – Environment Agency Science Report – SC030172/SR4a
[6] Highways Agency 2007 Design Manual for Roads and Bridges Volume 11 Section 3 as updated by HA207/07.

* Pyrolyser emission rates are multiplied by four

** Four stacks (0.6m) combined within one wind shield

The approach recommended by the Environment Agency (2011a) has been used to predict annual mean nitrogen dioxide concentrations and the 99.8th percentile of 1-hour mean nitrogen dioxide concentrations from the model predictions of nitrogen oxides. This assumes that:

Annual mean nitrogen dioxide concentrations = Annual mean nitrogen oxides x 0.7; and

99.8th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.8th percentiles of 1-hour mean nitrogen oxides x 0.35.

Entrainment of the plume into the wake of nearby buildings (the so-called building downwash effect) has been fully taken into account for the ERF stacks. The modelled ERF buildings, digester and digestate tanks and stack locations are shown in the contour figures in the Results section. A summary of modelled buildings and their heights are shown in the Table overleaf.

Modelled buildings

Building	Height (m)	Width (m)	Length (m)
Facility Building (Main building)	9	40.6	130.6
Digester Tanks (x2)	9.5	25 (diameter)	
Digestate Tanks (x2)	9.5	25 (diameter)	
Gas Holder	9	6 (diameter)	

The model requires the input of meteorological data. Hourly sequential meteorological data from the Church Fenton meteorological station for the latest five years (2007 to 2011) have been used for this assessment. Five years of meteorological data have been used in order to allow for worst-case conditions to be identified, with respect to dispersion. The model results in the ES chapter are all reported for the worst-case meteorological year, which has been determined on a receptor-by-receptor basis.

APPENDIX 7.3

CONSTRUCTION DUST ASSESSMENT CRITERIA

Assessment Procedure

The criteria developed by IAQM divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

The assessment procedure is split into four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

An assessment is required where there are sensitive receptors within 350 m of the boundary of the site and/or within 100 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible*.

STEP 2: Assess the Risk of Dust Effects Arising

The risk of dust effects is determined by:

- the scale and nature of the works, which determines the risk of dust arising; and
- the proximity of sensitive receptors.

The risk categories assigned to the site are different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Demolition

The potential dust emission classes for demolition are as follows:

Large: Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete),on site crushing and screening, demolition activities >20m above ground level;

Medium: Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level; and

Small: Total building volume <20,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

The potential dust emission class determined above should be used in the matrix in the Table below to determine the **demolition risk category** with no mitigation applied based on the distance to the nearest receptors.

Risk Category from Demolition Activities

Distance to Nearest Receptor (m)[a]		Dust Emission Class		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
<20	**-**	High Risk Site	High Risk Site	Medium Risk Site
20 – 100	**<20**	High Risk Site	Medium Risk Site	Low Risk Site
100 – 200	**20 – 40**	Medium Risk Site	Low Risk Site	Low Risk Site
200 – 350	**40-100**	Medium Risk Site	Low Risk Site	Negligible

[a] These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

Earthworks and Construction

The potential dust emission classes for earthworks are as follows:

Large: Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000tonne;

Medium: Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000tonne – 100,000tonne; and

Small: Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000tonne, earthworks during wetter months.

The potential dust emission classes for construction are as follows:

Large: Total building volume >100,000m3, piling, on site concrete batching; sandblasting

Medium: Total building volume 25,000m3 – 100,000m3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and

Small: Total building volume <25,000m3, construction material with low potential for dust release (e.g. metal cladding or timber).

These potential dust emission classes should then be used in the matrix in the Table below to determine the earthworks risk category and the construction risk **category** with no mitigation applied.

Risk Category from Earthworks and Construction Activities

Distance to Nearest Receptor (m)[a]		**Dust Emission Class**		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
<20	**-**	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	**-**	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	**<20**	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	**20 – 40**	Medium Risk Site	Low Risk Site	Negligible
200 – 350	**40-100**	Low Risk Site	Low Risk Site	Negligible

[a] These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

Trackout

The potential dust emission classes for trackout are as follows:

Large: >100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;

Medium: 25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and

Small / Medium: <25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

These potential dust emission classes should be used in the Table below to determine the risk category for trackout with no mitigation applied.

Risk Category from Trackout

Distance to Nearest Receptor (m)[a]		**Dust Emission Class**		
Dust Soiling and PM_{10}	**Ecological**	***Large***	**Medium**	**Small**
<20	**-**	High Risk Site	Medium Risk Site	Medium Risk Site
20 – 50	**<20**	Medium Risk Site	Medium Risk Site	Low Risk Site
50-100	**20-100**	Low Risk Site	Low Risk Site	Negligible

[a] For trackout the distance is from the roads used by construction traffic.

There is an extra dimension to the assessment of trackout, as the distance over which it might occur depends on the site. As general guidance, significant trackout may occur up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. These distances assume no site-specific mitigation.

The 'distance to receptor' in Table 7.4.3 relates to the distance from the road where mud may be deposited. Therefore in determining the risk from trackout, both distances need to be taken into account.

STEP 3: Identify the Need for Site-specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is a low, medium or high risk site.

STEP 4: Define Effects and their Significance

The significance is determined using professional judgement, taking account of the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks set out within the risk effects summary table. The sensitivity of the area is defined as very high, high, medium and low.

The sensitivity of the area surrounding the construction / demolition site is combined with the risk of the site giving rise to dust effects to define the significance of the effects for each of the four activities (demolition, earthworks, construction and trackout).

Examples of Factors Defining Sensitivity of an Area

Sensitivity of area	Examples	
	Human receptors	Ecological receptors[a]
Very high	• Very densely populated area. • More than 100 dwellings within 20m. • Local PM_{10} concentrations exceed the objective. • Contaminated buildings present. • Very sensitive receptors (e.g. oncology units). • Works continuing in one area of the site for more than one year.	European Designated site.
High	• Densely populated area. • 10-100 dwellings within 20m of site. • Local PM_{10} concentrations close to the objective (e.g. annual mean 36-40 $\mu g/m^3$). • Commercially sensitive horticultural land within 20m.	Nationally Designated site.
Medium	• Suburban or edge of town area. • Less than 10 receptors within 20m. • Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 $\mu g/m^3$).	Locally designated site.
Low	• Rural area; industrial area	No designations.

Sensitivity of area	Examples	
	Human receptors	Ecological receptors[a]
	• No receptors within 20m • Local PM_{10} concentrations well below the objectives (less than 75%) • Wooded area between site and receptors	

[a] Only if there are habitats that might be sensitive to dust

Significance of Effects for Each Activity Without Mitigation.

Sensitivity of surrounding area	Risk of site giving rise to dust effects		
	High	Medium	Low
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight Adverse	Negligible	Negligible

Significance of Effects for Each Activity With Mitigation.

Sensitivity of surrounding area	Risk of site giving rise to dust effects		
	High	Medium	Low
Very High	Slight adverse	Slight adverse	Negligible
High	Slight adverse	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

The final step is to determine the overall significance of the effects arising from the construction phase of a proposed development. This is based on professional judgement but takes into account of the significance of the effects for each of the four activities.

APPENDIX 7.4

IMPACT DESCRIPTORS AND ASSESSMENT OF SIGNIFICANCE

There is no official guidance in the UK on how to describe the nature of air quality impacts nor to assess their significance. The approach developed by the Institute of Air Quality Management7 (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. This involves three distinct stages: the application of descriptors for magnitude of change; the description of the impact at each sensitive receptor; and then the assessment of overall significance of the scheme.

Impact Descriptors

The definition of ***impact magnitude*** is solely related to the degree of change in pollutant concentrations, expressed in microgrammes per cubic metre, but originally determined as a percentage of the air quality objective. ***Impact description*** takes account of the impact magnitude and of the absolute concentrations and how they relate to the air quality objectives or other relevant standards. The descriptors for the magnitude of change due to the scheme and the impact descriptors are presented in the Tables below. These tables have been designed to assist with describing air quality impacts at each specific receptor. They apply to the pollutants relevant to this scheme and the objectives against which they are being assessed.

Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. days with PM_{10} concentration greater than 50 µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase/decrease ≥4 µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5 µg/m^3
Medium	Increase/decrease 2 - <4 µg/m^3	Increase/decrease 3 or 4 days	Increase/decrease 1.25 - <2.5 µg/m^3
Small	Increase/decrease 0.4 - <2 µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase/decrease <0.4 µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25 µg/m^3

Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide, PM10 and PM2.5 Concentrations and Changes to Number of Days with PM10 Concentration Greater than 50 µg/m3 at a Receptor a

Absolute Concentration [b] in Relation to Objective/Limit Value	Change in Concentration/day [c]		
	Small	**Medium**	**Large**
Above Objective/Limit Value [d]	Slight	Moderate	Substantial
Just Below Objective/Limit Value [e]	Slight	Moderate	Moderate
Below Objective/Limit Value [f]	Negligible	Slight	Slight

7 The IAQM is the professional body for air quality practitioners in the UK.

Well Below Objective/Limit Value [g]	Negligible	Negligible	Slight

[a] Criteria have been adapted from the published criteria to remove overlaps at transitions.

[b] The 'Absolute Concentration' relates to the 'With-Scheme' air quality where there is an increase in concentrations and to the 'Without-Scheme' air quality where there is a decrease in concentrations.

[c] Where the Impact Magnitude is *Imperceptible*, then the Impact Description is *Negligible*.

[d] Where the Impact Magnitude is *Imperceptible*, then the Impact Description is *Negligible*.

[d] 'Above': >40 $\mu g/m^3$ annual mean NO_2 or PM_{10}, >25 $\mu g/m^3$ annual mean $PM_{2.5}$, or >35 days with PM_{10} > 50 $\mu g/m^3$.

[e] 'Just below': >36 – ≤40 $\mu g/m^3$ of annual mean NO_2 or PM_{10}, >22.5 - ≤25 $\mu g/m^3$ annual mean $PM_{2.5}$, or >32 – ≤35 days with PM_{10} >50 $\mu g/m^3$.

[f] 'Below': >30 – ≤36 $\mu g/m^3$ of annual mean NO_2 or PM_{10}, >18.75 - ≤22.5 $\mu g/m^3$ annual mean $PM_{2.5}$, or >26 – ≤32 days with PM_{10} >50 $\mu g/m^3$.

[g] 'Well below': ≤30 $\mu g/m^3$ annual mean NO_2 or PM_{10}, ≤18.75 $\mu g/m^3$ annual mean $PM_{2.5}$, or ≤26 days with PM_{10} >50 $\mu g/m^3$.

Assessment of Significance

The IAQM (Institute of Air Quality Management, 2009) guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either, *insignificant, minor, moderate* or *major*. In drawing these conclusions, the factors set out in the table below should be taken into account.

Factors Taken into Account in Determining Air Quality Significance

Factors
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.
The magnitude of the changes and the descriptions of the impacts at the receptors using the criteria set out in Table 7.5.1 and Table 7.5.2.
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made
The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$

APPENDIX 7.5

BASELINE CONDITIONS

Wakefield District Council Monitoring

The plan below shows monitoring locations within Castleford and the location of the Castelford AQMA.

Monitoring Locations and Castleford AQMA

The following tables show the results of nitrogen dioxide and PM_{10} monitoring in Castleford, as described in Section 7.4 of the ES chapter.

Summary of Nitrogen Dioxide (NO_2) Monitoring (2007-2010) [a] [b]

Site Type	Location	2007	2008	2009	2010	2011
Automatic Monitor - Annual Mean (μg/m^3) [c]						
Roadside	Pontefract Road	-	-	36 [c]	35	31
Objective		**40**				
Automatic Monitor - No. of Hours > 200 μg/m^3						
Roadside	Pontefract Road	-	-	0	0	0
Objective		**18**				
Diffusion Tubes - Annual Mean (μg/m^3) [b]						
Roadside	21 Ferrybridge Road	**58**	**55**	**52**	**51**	**46**
Roadside	20 Saville Road	**52**	**44**	**40**	39	**45**
Background	75a Pontefract Road	**43**	**45**	**44**	**47**	**47**

Site Type	Location	2007	2008	2009	2010	2011
Roadside	121 Saville Road	**41**	36	30	30	35
Background	71 Pontefract Road	39	**42**	**41**	**45**	37
Background	17 Ferrybridge Road	**41**	38	**45**	**50**	**41**
Background	2 Wood Street	34	38	**43**	36	34
Roadside	1 Newfield Avenue	32	29	27	**-**	**-**
Objective		**40**				

[a] Exceedences of the objectives are shown in bold

[b] 2009 to 2011data have been taken from the 2012 Updating and Screening Assessment (WDC, 2012). 2008 data have been taken from the 2011 Progress Report. 2007 data was provided by WDC.

[c] The automatic analyser was relocated from an urban background site adjacent to Park Junior School to the roadside site at Pontefract Road in July 2009.

Summary of PM_{10} Automatic Monitoring, Pontefract Road, Castleford (2009 – 2011) [a b]

Year	Annual Mean (μg/m^3)	Number of Days > 50 μg/m^3
2009 [c]	18	0
2010	24	4
2011	20	3
Objective	**40**	**35**

[a] Exceedences of the objectives are shown in bold

[b] 2009 to 2011data have been taken from the 2012 Updating and Screening Assessment (WDC, 2012). 2008 data have been taken from the 2011 Progress Report. 2007 data was provided by WDC.

[c] The automatic analyser was relocated from an urban background site adjacent to Park Junior School to the roadside site at Pontefract Road in July 2009.

<u>Background Concentrations</u>

The following tables show the background concentrations, background deposition fluxes, background trace metal concentrations and background PCDD/Fs concentrations used in the assessment.

Estimated Annual Mean Background Pollutant Concentrations in 2011 and 2015 (μg/m^3)[a]

Year	NO_x	NO_2	PM_{10}	$PM_{2.5}$
2011 [b]	17.4 – 25.5	14.8 – 22.6	14.4 – 16.0	9.3 – 10.5
2015 – Without Reductions in Traffic Emissions [c]	n/a	13.9 – 20.9	n/a	n/a
2015 – With Reductions in Traffic Emissions [d]	14.4 – 21.5	12.4 – 19.2	13.8 – 15.3	8.8 – 9.7
Objectives	**30**	**40**	**40**	**25 [e]**

n/a = not applicable

[a] The range in concentrations is for the different grid squares across the study area.

[b] This assumes vehicle emission factors in 2011 remain the same as 2008 (See Technical Appendix 7.3).

[c] This assumes vehicle emission factors in 2015 remain the same as in 2011.

[d] This assumes vehicle emission factors reduce into the future at the current 'official' rates.

[e] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 $\mu g/m^3$ is to be met by 2015.

Background Deposition Fluxes at Fairburn and Newton Ings in 2009 and 2011 [a]

Pollutant	2009 – 2011	Worst-case Critical Load [b]
Nutrient Nitrogen Deposition (kgN/ha/yr)	21.4	**10**
Acid Nitrogen Deposition (keq/ha/yr)	1.39	**1.033**
Total Acid Deposition (keq/ha/yr)	1.63	**1.033**

[a] Values published on the APIS website. Accessed 12th August 2013

[b] The minimum relevant value from Table 7.2.4 in Technical Appendix 7.2.

Trace Metal Background Concentrations, 2011 (ng/m^3)

Metal	Sheffield Centre	Sheffield Brinsworth	Scunthorpe Town	Scunthorpe Low Santon
Antimony	Not measured			
Arsenic	0.6	0.9	0.8	0.9
Cadmium	0.2	0.4	0.2	0.2
Chromium	6.6	33.3	5.1	5.2
Cobalt	Not measured			
Copper	11.3	17.2	6.1	5.6
Lead	11.5	21.6	20.4	38.3
Manganese	11.7	32.1	26.5	86.3
Mercury	0.0	0.1	0.0	0.0
Nickel	2.1	12.6	1.4	1.5
Thallium	Not measured			
Vanadium	1.3	1.3	1.6	5.2

UK PCDD/Fs Concentrations (fg/m^3)

Metal	2008	2009	2010
Manchester	19.0	14.2	48.7
Hazelrigg	3.7	13.5	8.0
London	10.9	41.4	38.6
High Muffles	1.7	9.4	2.8
Auchencorth	6.4	0.6	5.0
Middlesborough	24.0	-	-
Weybourne	-	22.8	2.5

APPENDIX 7.6

POTENTIAL SIGNIFICANT EFFECTS - OPERATION

The Factors taken into account in determining the overall significance of the scheme on local air quality are presented within the following table (as described in Section 7.5 of the ES chapter.)

Factors Taken into Account in Determining the Overall Significance of the Scheme on Local Air Quality

Factors	Outcome of Assessment
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.	A small number of people, along Wheldon Road are predicted to be exposed to a medium to large increase in concentrations. A small number of people, along Saville Road are predicted to be exposed to a small increase in concentrations.
The magnitude of the changes and the descriptions of the impacts at the receptors	The impacts at the receptors range from *negligible* to *slight adverse*.
Whether or not an exceedence of an objective is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.	No new areas of exceedence of the objective are predicted.
Uncertainty, including the extent to which worst-case assumptions have been made	The inclusion of the two scenarios for nitrogen dioxide covers the uncertainty over vehicle emission factors. The actual concentrations are likely to lie between the two scenarios.
The extent to which an objective is exceeded	The annual mean nitrogen dioxide objective is not exceeded in the with emissions reductions scenario, but is exceeded at one receptor in the without emissions reduction scenario. This receptor is located within the Castleford AQMA.

APPENDIX 7.7

CONSTRUCTION MITIGATION

The following is a list of generic dust control measures provided by the IAQM. These will not all be relevant to the works being carried out, but should be used, as appropriate, to specify the measures required.

Communications

- Implement a stakeholder communications plan that includes community engagement before and during work on site; and
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager.

Dust Management Plan

- Implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management.

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;' and
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

Monitoring

- Undertake daily on-site and off-site inspection where receptors (including roads) are nearby, to monitor dust, record inspection results, and make available the log to the local Authority when asked;
- When activities with a high potential to produce dust are being carried out, and during prolonged dry or windy conditions, increase the frequency of inspections;
- Carry out regular dust soiling checks of surfaces such a street furniture, cars and window sills within 100m of site boundary;
- Implement a monitoring scheme for dust deposition/flux consistent with IAQM guidance. Agree monitoring locations and Site Action Levels with the Local Authority; and
- Implement a scheme for real-time continuous PM10 monitoring consistent with IAQM guidance. Agree monitoring locations and Site Action Levels with the Local Authority.

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. Use intelligent screening where possible – e.g. locating site offices between potentially dusty activities and the receptors;
- Erect solid screens or barriers around the site boundary;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean;
- 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; and
- Depending on the duration that stockpiles will be present and their size - cover, seed, fence or water 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 un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- Implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

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;
- Use enclosed chutes, conveyors and covered skips, where practicable; and

- 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

- Only use registered waste carriers to take waste off-site; and

- Avoid bonfires and burning of waste materials.

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 a small areas during work and not all at once.

Measures Specific to Construction

- Avoid scabbling, if possible;

- 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; and

- 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.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as soon as practicable any material tracked out of the site. This may require the sweeper being continuously in use;

- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;

- Record all inspections of haul routes and any subsequent action in a site log book;

- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;

- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as practicable;

- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site); and

- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. This can be in the form or a static drive through facility or a manually operated power jet.

Pell Frischmann

excellence through innovation

WHELDON

Advanced Conversion Technology and Anaerobic Digestion Facility

FLOOD RISK ASSESSMENT

R57016T11Y001-B

July 2013

Submitted by Pell Frischmann

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A	Initial Issue	July 12	HM	SG	PDG
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CONTENTS

1. INTRODUCTION

Pell Frischmann has been appointed by Clean Power Properties Ltd to undertake a Flood Risk Assessment (FRA) in support of the planning application for the proposed Advanced Conversion Technology and Anaerobic Digestion Facility at Wheldon near Castleford.

This report has been provided to meet current legislative requirements and industry best practice. It is anticipated that the National Standards for sustainable drainage will be finalised and released in 2014. Following the release of this guidance, the surface water drainage strategy for the proposed development may need to be revised to take into account the changes set out in this document.

2. THE SITE

2.1 SITE LOCATION

The proposed site covers an area of approximately 5.3 ha and is roughly rectangular in shape. The site is located north of Castleford and 27 km to the east of Wakefield. The River Aire is located to the north of the site as illustrated in Figure 1 below.

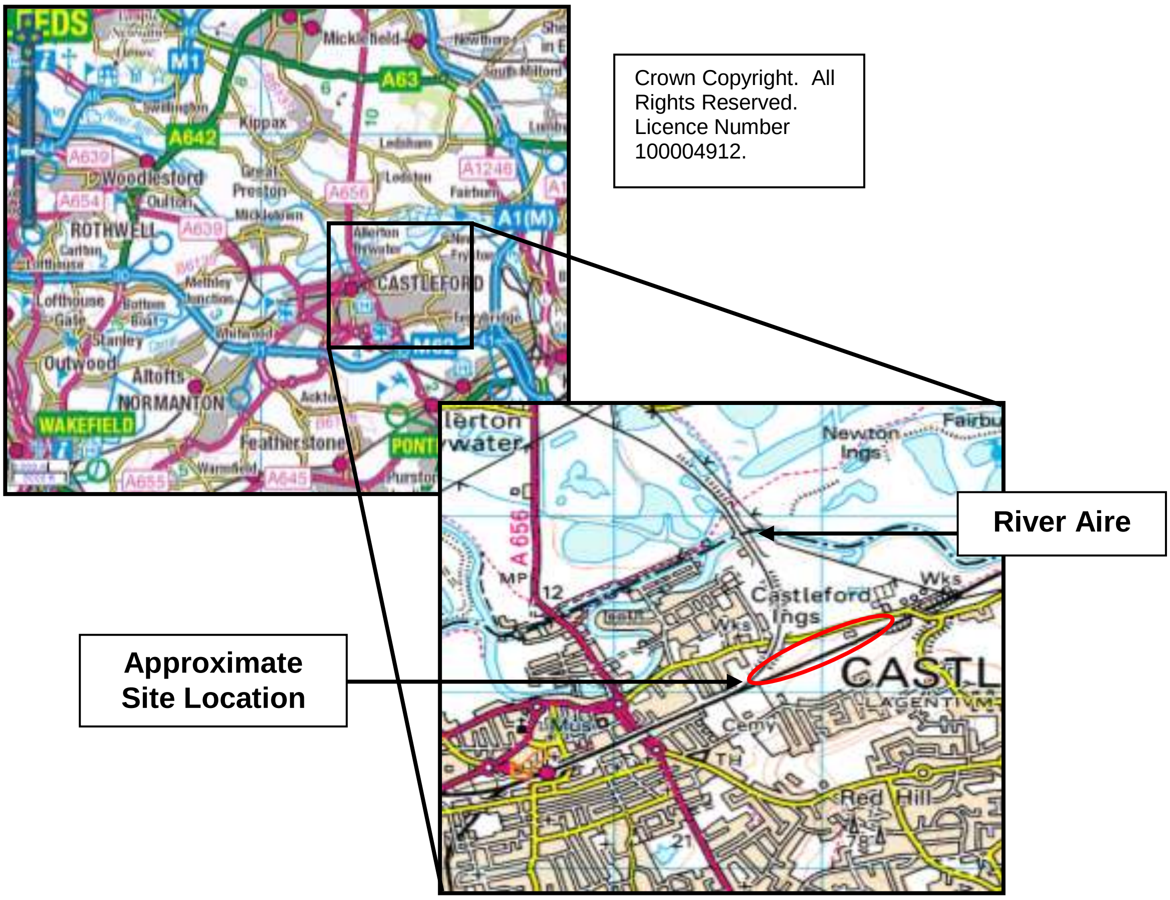


Figure 1 – Location Plan of the site

2.2 SITE DESCRIPTION

The site is currently partly used as a rail siding and covers an area of approximately 5.3 ha including the access road. The site previously formed part of Wheldale Collieries and has been used as railway sidings. The site is no longer required for railway purposes and therefore the railway lines on the site have been removed. The site currently comprises rough ground, a curved strip of mature trees and vegetation (grass). There is a hardstanding path running north to south and a track which runs parallel to the southern boundary of the site as indicated in Figure 2 below.

Figure 2 – Aerial Photograph Of The Site

The site is bound to the north by Wheldon Road with industrial works, marshes and the village of Allerton Bywater. The site is bound to the east by a mine, a railway line and residential parts of Castleford. The site is bound to the south by Castleford and the M62. The site is bound to the west by a railway line, Castleford Tigers Rugby Club and the town of Castleford beyond.

2.3 WATERCOURSE

The River Aire is located approximately 450 m to the north of the site. The Aire and Calder Navigation, known as the Castleford Cut in this stretch of the navigation, discharges into the River Aire approximately 600 m to the north of the site. The River Calder discharges into the River Aire approximately 1500 m to the west of the site. To the north of the River Aire, the area is heavily populated with water marshes; Newton Ings, Fairburn Ings and Wheldale Ings. There is an elongated pond approximately 100 m to the north of the site running adjacent to a disused railway line. It may drain Weldon Road and the disused railway line. The water infrastructure in relation to the site is illustrated in Figure 3 below.

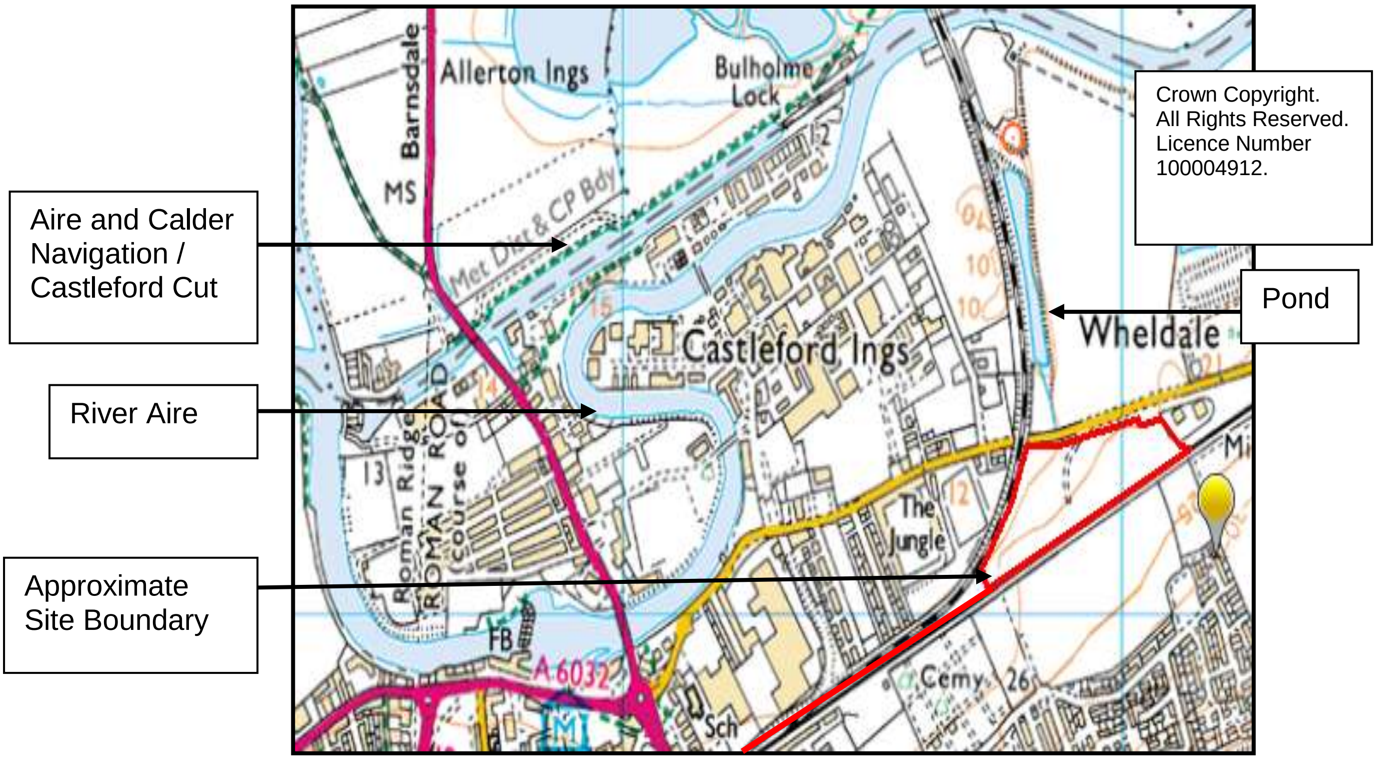


Figure 3 – Watercourses Near To The Site

3. TOPOGRAPHY

A topographical survey was undertaken in June 2012 by David J Webb Surveys and is included in Appendix B. It indicates that the site slopes from the south east at 21.35 mAOD to the west at 14.08 mAOD. Wheldon Road to the north of the site lies at a level of 14.98 mAOD and the access track lies at 15.41 mAOD.

4. GEOLOGY

The Geo-Environmental Assessment Report (ref E57016/VBA/T08/01) states that the north western section of the site is underlain by superficial deposits of Alluvium comprising Clay, Silt, Sand and Gravel. The site is underlain by the Pennine Middle Coal Measures Formation comprising Mudstone, Siltstone and Sandstone.

Furthermore, the site is not located within a Source Protection Zone (SPZ).

5. EXISTING FLOOD RISK

5.1 FLUVIAL FLOOD RISK

The Environment Agency's (EA) Flood Map indicates that the north western boundary of the site lies within an area at medium risk of flooding, Flood Zone 2. Also Flood Zone 2 is shown to extend up to the railway embankment at the south west of the site. Flood Zone 2 comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1 % - 0.1 %) in any year.

It appears that the railway embankment to the north west of the site, demarks the edge of the Flood Zone 3; an area at high risk of flooding as illustrated in Figure 4 below and in Appendix C.

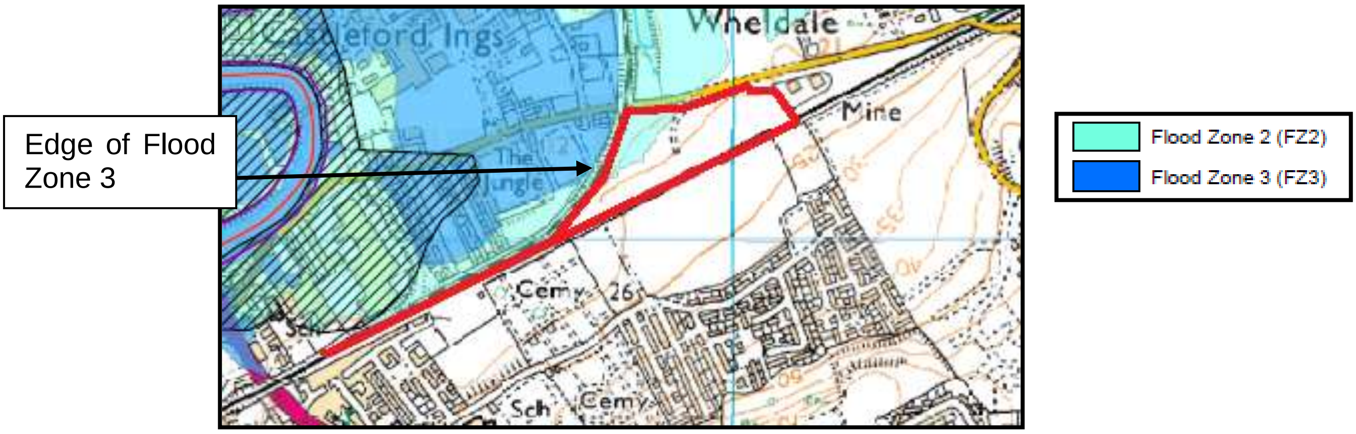


Figure 4 – EA Flood Map

The EA Flood Map indicates that all proposed development as well as the vehicular access road is outside of Flood Zone 2 and 3. There is considered to be a low risk of fluvial flooding to the site.

The EA Flood Map also identifies that there is ‘An Area Benefitting From Flood Defences’ situated to the west of the site. This area includes the school to the south of Wheldon Road and the residential area sandwiched between the River Aire and the Aire and Calder Navigation.

5.2 GROUNDWATER FLOOD RISK

British Geological Survey maps illustrate that the site is shown to be underlain by Mudstone, Siltstone and Sandstone from the Pennine Lower Coal Measures Formation. Furthermore, the groundwater levels are low in the area therefore the site is considered to have a low risk of groundwater flooding.

5.3 SURFACE WATER FLOOD RISK

There are no known surface water flooding issues on the site. It is recommended that surface water from the proposed development will be controlled using appropriate Sustainable Drainage Systems (SuDS) to ensure the development does not have a negative impact on the downstream catchment. There is considered to be a low risk of flooding from surface water.

5.4 EXISTING FLOOD DEFENCES

The EA provided information about flood defences near the site and is included in Appendix C. A defence map of the site indicates that there are defences along the River Aire which comprise ‘high ground’ which extend from Bulholme Lock, situated to the north of the site, to Fairburn Ings, situated to the north east of the site.

The defences are considered to have a design standard of 1 in 100 years. The EA rate the condition of defences based on performance. Each asset is given a rating between one and five with one being very good condition and five being very poor. A condition rating of three or 'fair' is the minimal acceptable standard for a critical asset, such as a defence wall that protects properties. The defences along the River Aire north of the site have been rated as two.

5.5 FLOOD HISTORY

The EA provided information about historical flooding for the site and is included in Appendix C. It indicates that the site has not flooded in the past. The flood history map illustrates that flood levels on the River Aire during the Autumn 2000 flood event were 11.37 mAOD. The River Aire flooded in January 2008, 2007, February 2002, Autumn 2000, 1995 and 1978. The flood history map indicates that the flood waters were at least 300 m or more away from the site during these flood events.

6. PROPOSED DEVELOPMENT

The proposed development comprises an Advanced Conversion Technology and Anaerobic Digestion Facility. The proposed site layout is included in Appendix B. The proposals comprise one rectangular shaped building which will be split into four zones including a reception and offices. The proposals also indicate a rail unloading area to the north corner of the site, car parking to the east of the building and four tanks situated to the western site boundary.

It is proposed that the existing access road, situated to the north east of the site will be utilised within the scheme. An additional access road will be constructed to the north east of the site from Wheldon Road.

6.1 SEQUENTIAL TEST

The Technical Guidance to the National Planning Policy Framework (NPPF) identifies that the Sequential Test should be carried out to ensure that sites are chosen within low areas of flood risk. The Technical Guidance to the NPPF states that waste treatment facilities are classified as ‘Less Vulnerable’ within the Flood Risk Vulnerability Classification. The Flood Risk Vulnerability and Flood Zone Compatibility (Table 3) in the Technical Guidance to the NPPF indicates that ‘Less Vulnerable’ developments are appropriate for location in all flood zones, except Flood Zone 3b ‘Functional Floodplain’.

The site lies 2 m above the 1 in 100 year flood level with an allowance for climate change therefore the site is considered to be within Flood Zone 1. As a result, the proposed development is considered to meet the requirements of the Sequential Test.

6.2 FLOOD LEVELS

The EA provided modelled flood levels at various nodes along the River Aire. A map showing the location of the nodes is included in Appendix C. Node 2671203687 and node 2671203432 are located on the River Aire north of the proposed site. A summary of the flood levels for a range of return periods are included in Table 1 below.

	Flood Levels (mAOD)							
Node	**10 Year Stage**	**25 Year Stage**	**50 Year Stage**	**100 Year Stage**	**100 Year Stage plus CC 2025**	**200 Year Stage**	**100 Year Stage plus CC 2115**	**Undefended 100 Year Stage**
2671203687	11.77	11.92	12.20	12.52	12.73	12.70	12.92	12.36
2671203432	11.75	11.89	12.17	12.48	12.69	12.66	12.88	12.32

Table 1 – Modelled Flood Levels for the River Aire

The table identifies that node 2671203687 presents the most conservative flood levels and therefore has been used to assess the risk of flooding to the site.

6.2.1 Analysis of Flood Levels and Topographic Survey

An analysis of the flood levels and the topographic survey, included in Appendix B, indicates that the lowest point on site lies at approximately 15 mAOD which is 2.08 m above the 1 in 100 year flood level plus an allowance for climate change up to 2115, 12.92 mAOD. It is considered inappropriate to provide flood mitigation as the site lies well above the flood levels which provides a substantial freeboard.

6.2.2 EA Consultation

The EA Development Control and Flood Risk Officer, Andy Ransome, was consulted in relation to the proposal. During a conversation on 4th July 2012, he stated that as the topographical survey indicates that the site lies in excess of 2 m above the 1 in 100 year plus climate change (2115) flood level of 12.92 mAOD, no flood mitigation measures are required.

6.3 DEVELOPMENT DESIGN HORIZON

As the proposed development is an Advanced Conversion Technology and Anaerobic Digestion Facility the design life (in terms of flood risk and drainage design) is identified as 60 years in accordance with current best practice.

6.4 CLIMATE CHANGE IMPACTS

The potential impact of climate change is expected to cause an increase in the magnitude and frequency of extreme weather events as outlined in the Technical Guidance to the NPPF. The proposed development should seek to mimic the existing drainage situation through the use of Sustainable Drainage Systems (SuDS) where practicable and an allowance for climate change should be included.

6.5 INCREASED RAINFALL INTENSITY

Guidance set out in Table 5 of the Technical Guidance to the NPPF states that by 2085 peak rainfall intensities could increase by up to 20 %. Calculations of future run-off rates should be undertaken with a factor of 20 % added to the rainfall intensity parameter to represent the potential for increased rainfall intensities to 2085.

6.6 INCREASED FLUVIAL FLOW

The Technical Guidance to the NPPF identifies that peak river flows may increase by up to 20 % in the coming century. Design calculations for culverts and river crossings required for this scheme should make an allowance in line with this guidance to ensure the impacts of climate change are accommodated within the proposed development.

7. SURFACE WATER DRAINAGE STRATEGY

7.1 EXISTING SURFACE WATER DRAINAGE

There are currently no existing formal drainage arrangements on the site.

7.2 EXISTING SURFACE WATER RUNOFF RATES

The existing surface water runoff rates were calculated in order to determine the rates for the 1 in 1 year, 1 in 30 year and 1 in 100 year rainfall events. For the purpose of the surface water calculations, the site was considered to be Greenfield and therefore the Institute of Hydrology Report 124 (ICP SUDS) was used to determine the surface water runoff rate for this area using Micro Drainage. The urban factor was used during the calculation to represent the two small tracks on the site which cover an area of approximately 3625 m^2. The existing surface water runoff rates are indicated in Table 1 below and are included as Appendix D.

Return Period	1 in 1 Year	1 in 30 Year	1 in 100 Year
Runoff Rate (l/s)	19	38	45

Table 1 – Existing Surface Water Runoff Rates

7.3 PROPOSED SURFACE WATER DRAINAGE SYSTEM

In accordance with the Technical Guidance to the NPPF, discharge rates should be maintained at existing rates for equivalent return period storm events; i.e. future 1 in 1 year storms discharge at the existing 1 in 1 year runoff rate and future 1 in 100 year storms discharge at the existing 1 in 100 year runoff rate. An allowance for climate change must be made to account for the potential for increased rainfall intensities.

7.3.1 Sustainable Drainage Systems

The surface water drainage strategy will incorporate Sustainable Drainage Systems in line with the Technical Guidance to the NPPF. SuDS capture, store and release surface water and are designed to replicate predevelopment discharge rates and volumes as far as practical.

7.4 SURFACE WATER MANAGEMENT HIERARCHY

The surface water management hierarchy CIRIA SuDS Manual C697 states that surface water run-off should be managed as close to its source as possible in line with the following hierarchy detailed below:

1. Store rainwater for later use
2. Infiltration techniques
3. Attenuate in ponds or open water features for gradual release
4. Attenuate in tanks or sealed water features for gradual release
5. Discharge direct to a watercourse
6. Discharge to a surface water sewer
7. Discharge to a combined sewer

7.4.1 Store rainwater for later use

The report entitled *Technical Description Clean Power Properties Ltd January 2012* indicates that “the rainwater falling onto buildings will be harvested, treated and used within the process for steam generation and cleaning. All rainwater falling on hardstanding areas on the site will be harvested in a greywater storage tank and used for process wash down, floor cleaning and vehicle wash. During periods of excess rain and when both the rainwater and greywater storage tanks are full, rain water shall be discharged directly from the site in accordance with the surface water drainage strategy”.

7.4.2 British Geological Survey Infiltration SuDS Map

The British Geological Survey Infiltration SuDS Map was reviewed in relation to the proposed site. It indicates there are ‘very significant’ constraints at the site in the form of high groundwater levels which are shown to be less than 3 m below the ground level. It is recommended that site specific infiltration testing is carried out to determine the infiltration rate at the site as well as the level of the ground water.

7.5 PROPOSED INFILTRATION STORAGE

For the purpose of drainage design it is assumed that both the rainwater harvesting tank and the greywater storage tanks are full and therefore attenuation or appropriately sized soakaways must be provided in addition to these tanks.

The EA require that attenuation is designed to accommodate the 1 in 100 year rainfall event plus 20 % for climate change. The infiltration rate was assumed to be 0.1 m/hr as the Penine Lower Coal Measures are known to have good infiltration characteristics and 0.1 m/hr is a ‘low infiltration’ / conservative figure. The attenuation storage was calculated in outline in Micro Drainage. The calculation assumes that all rainwater infiltrates and there is no positive surface water runoff from the site. The calculation indicates that a cellular soakaway with a volume of 1360 m^3 is required. This is based on a cellular soakaway with a plan area of 1440 m^2, 1 m deep and 95 % porosity. The calculation has been included in Appendix E. It should be noted that the storage volume may change subject to the results of site specific infiltration testing, but that this figure is likely to be an upper limit. It is also recommended that any soakaway device is situated at least 5 m from any building in line with current best practice.

8. SUMMARY

- This FRA has been prepared in support of a planning application for the proposed development of an Advanced Conversion Technology and Anaerobic Digestion Facility at Wheldon near Castleford.

- The EA Flood Map indicates that the north west of the site is located within Flood Zone 2; an area at medium risk of flooding. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%).

- The proposal is classed as 'Less Vulnerable' in the Flood Risk Vulnerability Classification in the Technical Guidance to NPPF. As the site is not located within Flood Zone 3, it is recommended that the proposal meets the requirements of the Sequential Test.

- The EA provided flood levels for the 1 in 100 year return period plus an allowance for climate change (2115). It indicates that the ground level of the site lies in excess of 2 m above the flood level. As a result, the site is at low risk of flooding from the River Aire. The site plan indicates that there will be safe access and egress from the site during flood events as the vehicular access road is outside of Flood Zone 2 or 3. Furthermore the EA stated that no flood mitigation is required at this site.

- Sustainable Drainage Systems (SuDS) have been proposed to manage the surface water runoff at the site to mimic the natural drainage scenario.

- It is proposed that grey water on the site will be harvested, treated and used within the process for steam generation and cleaning. In addition, rain falling onto other hardstanding areas will be collected and used for process wash down, floor cleaning and vehicle wash.

- It is proposed to infiltrate the surface water runoff in line with the Surface Water Management Hierarchy. An initial review of the geology indicates that infiltration should be feasible on the site as the sole method of surface water drainage disposal. It is recommended that site specific infiltration testing is carried out on site to verify this.

- In addition, the surface water will be attenuated on the site to accommodate the 1 in 100 year event plus 20 % rainfall event. Outline calculations in Micro Drainage indicate that a soakaway with volume of 1360 m^3 is required to attenuate the surface water runoff from the site. The site was treated as a Greenfield site, with an urban factor to take account of the existing impermeable on the site, for the purpose of the drainage calculations.

- Soakaways should be located at least 5 m away from any building.

- It should be noted that the storage volume may alter depending on the infiltration rate determined from site specific testing.

9. LIMITATIONS AND UNCERTAINTIES

This report has been prepared by Pell Frischmann with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client.

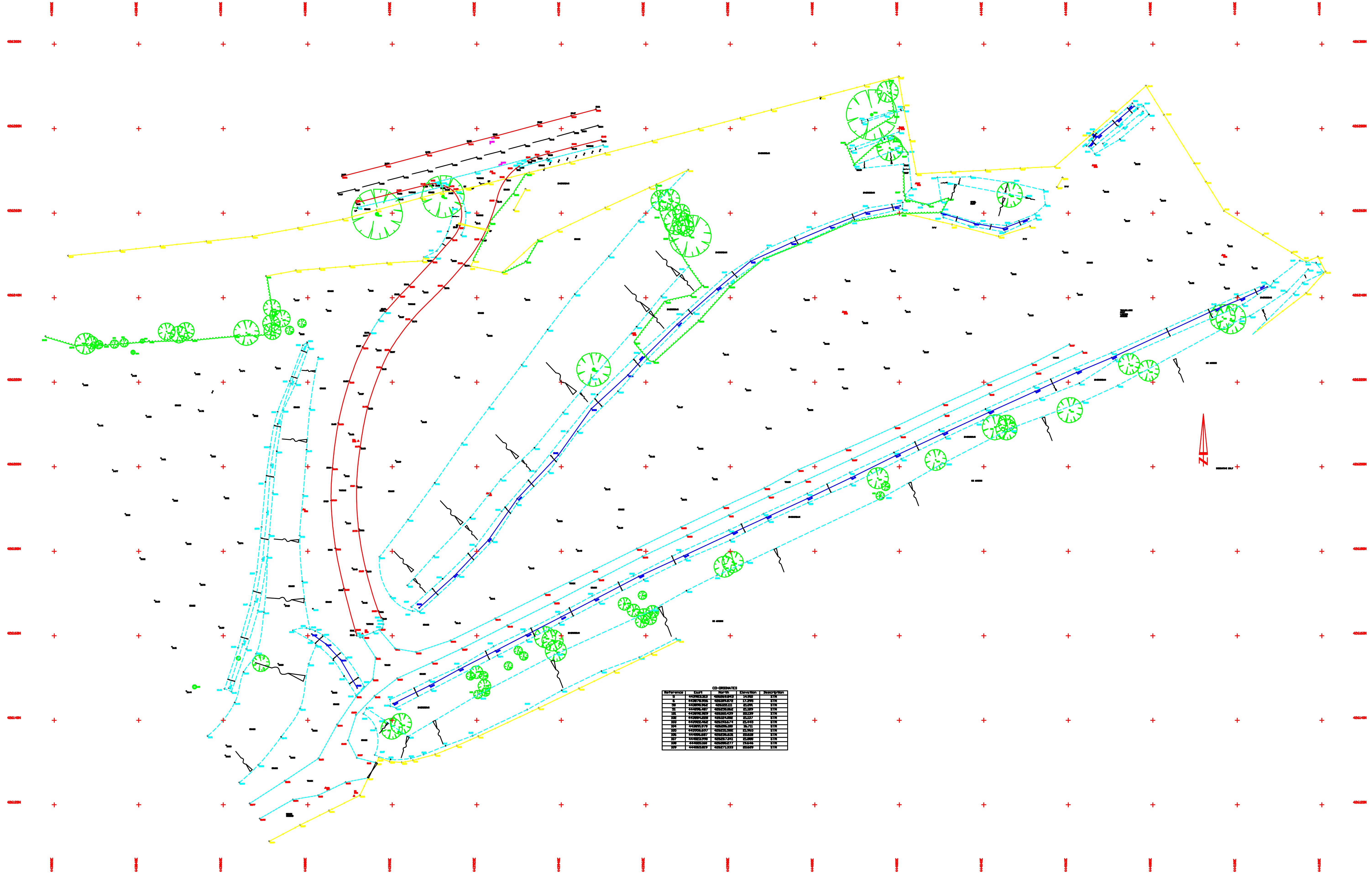
The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true representative data with respect to site conditions. The information reported herein is based on the interpretation of data collected during a desk based assessment of flood risk including information held by third parties for which we cannot be held responsible. Should additional information become available that may influence the opinions expressed in this report, Pell Frischmann reserves the right to review such information and, if warranted, to alter the opinions accordingly.

The evaluation and conclusions do not preclude the existence of other site conditions which could not reasonably have been revealed at the time of writing. This report should be used for information purposes only and should not be construed as a comprehensive characterisation of all site conditions. In addition, this report has been prepared solely for the use of the client, and may not be relied upon by other parties without written consent from Pell Frischmann.

Pell Frischmann disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

APPENDIX A

TOPOGRAPHIC SURVEY

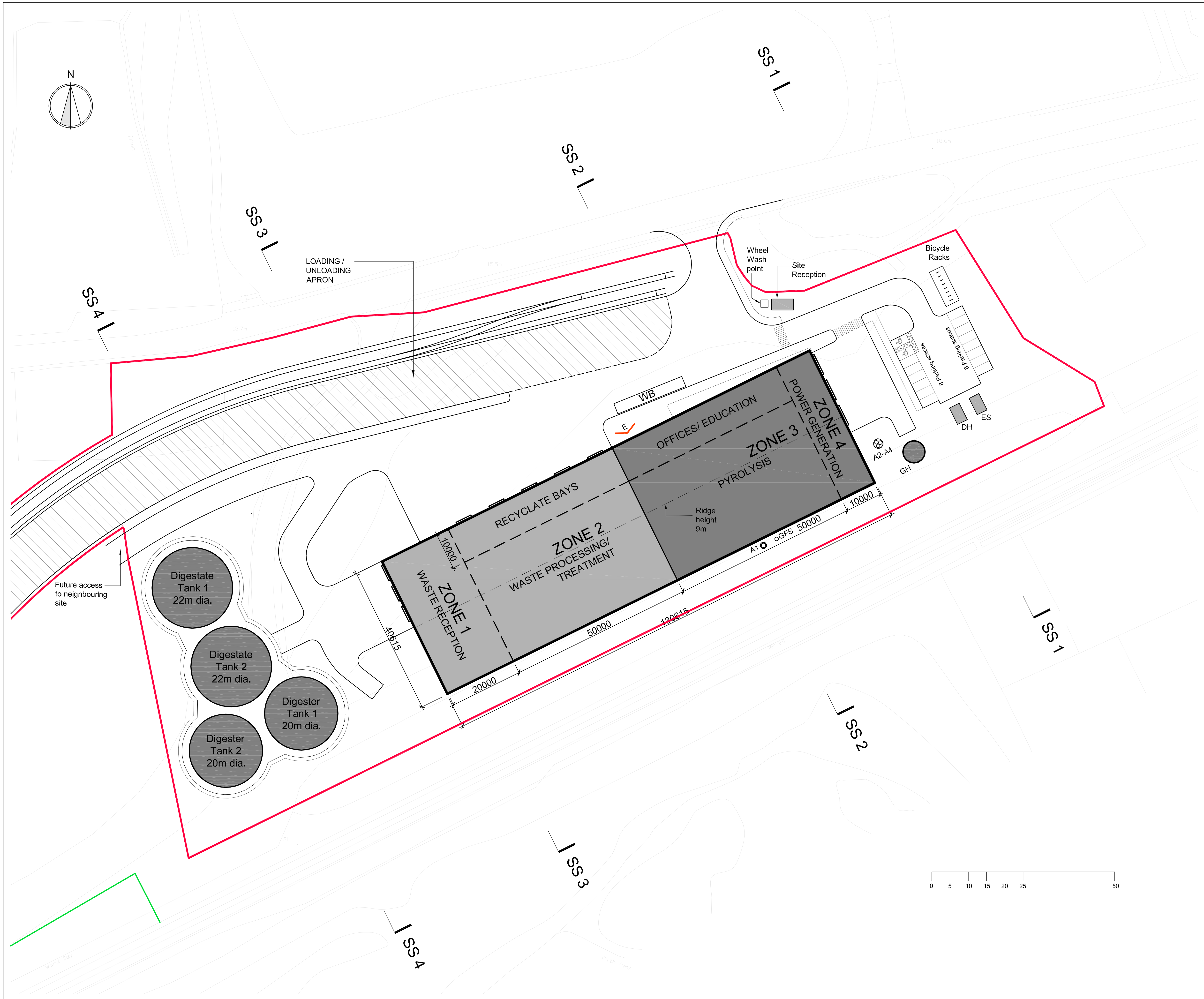


CO-ORDINATES

Reference	East	North	Elevation	Description
5	443923.313	426269.843	14.910	STN
6	443878.956	426189.872	17.395	STN
50	443890.962	426122.111	21.091	STN
51	444096.487	426250.062	21.189	STN
101	443892.929	426160.439	20.139	STN
102	443884.228	426124.002	21.137	STN
103	443922.462	426193.674	21.445	STN
104	443891.970	426206.100	16.711	STN
105	443956.697	426231.582	21.965	STN
106	444006.687	426236.631	20.618	STN
107	444023.990	426267.041	21.860	STN
108	444020.160	426280.277	19.646	STN
109	444065.819	426271.333	20.609	STN

APPENDIX B

PROPOSED SITE PLAN



Notes:

1. Do not scale from this drawing.
2. All dimensions are in millimeters unless otherwise stated.
3. All dimensions must be checked on site.
4. The designers shall be notified of any discrepancies.
5. This drawing has been produced for sole use on this project and is not intended for use by any other person or any other purpose.

DRAWING NOTES:

1. This drawing represents the schematic Site Layout arrangement, and is subject to detail design development.
2. The building interior is to be kept under negative pressure to prevent odour impacts.
3. All waste reception & deliveries will be carried out within the building.
4. Roof lights are to maximise natural daylight within the building.
5. Indicative planting shown only.

LEGEND:

WW:	Wheel washing
WB:	Weigh Bridge
A1-A4:	Emission stacks
GFS:	Gas flare stack
GH:	Gas holder tank
ES:	Electrical Sub Station
DH:	District Heating connection
SS 1-3:	Site Section lines
	New Trees
	Rail Interface Area
E	Main Entrance

REV	DATE	REVISION DETAILS	BY
C	01.07.13	Boundary amended	
B	28.05.13	General amendments. Site name updated.	
A	16.01.13	Layout amended to include loading and unloading apron	
/	25.07.12	PLANNING APPLICATION ISSUE Previously drawing SK-001 Rev C	

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environmental & transportation

12 GREENWAY FARM, BATH ROAD,
WICK, BRISTOL BS30 5RL

TEL : 0117 937 4077

PROJECT TITLE
Advanced Conversion Technology
& Anaerobic Digestion Facility,
WHELDON ROAD, Castleford

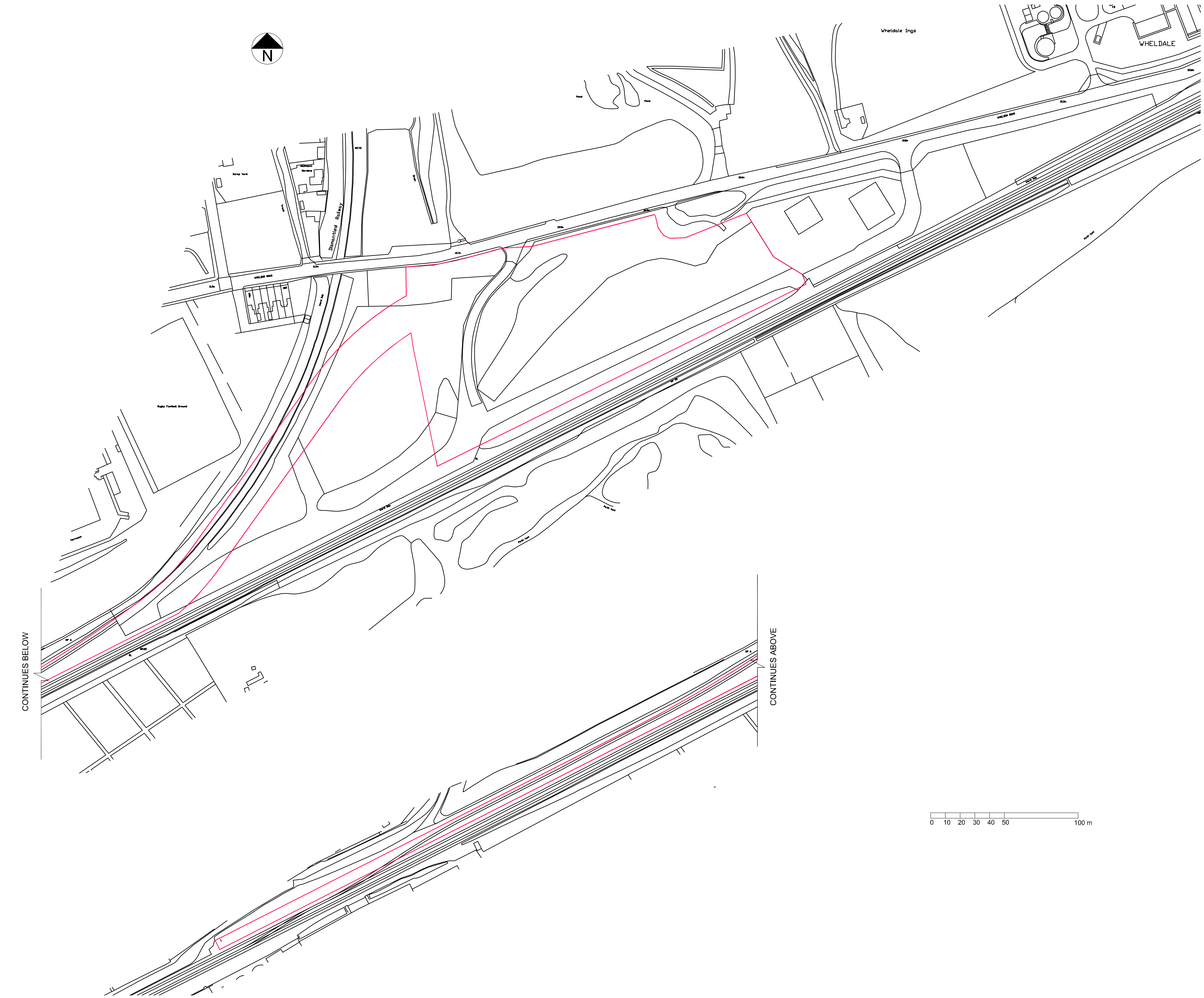
DRAWING TITLE
Proposed Site Layout

CLIENT
Clean Power Properties Ltd &
Network Rail Infrastructure Ltd

STATUS
PLANNING APPLICATION

SCALE		DRAWN
1:1000	AT A3	JW
CHECKED		APPROVED
RW		RW

DRG SIZE	DATE	DRAWING NUMBER	REV
A3	23.07.12	CPPL-05/10-01	C



Notes:

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REV	DATE	REVISION DETAILS	BY
A	01.07.13	BOUNDARY UPDATED	
/	25.07.12	PLANNING APPLICATION ISSUE	

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12 GREENWAY FARM, BATH ROAD,
WICK, BRISTOL BS30 5RL

TEL : 0117 937 4077

PROJECT TITLE
Advanced Conversion Technology & Anaerobic Digestion Facility, WHELDON, Allerton Bywater

DRAWING TITLE
Site Location Plan

CLIENT
Clean Power Properties Ltd & Network Rail Infrastructure Ltd

STATUS
PLANNING APPLICATION

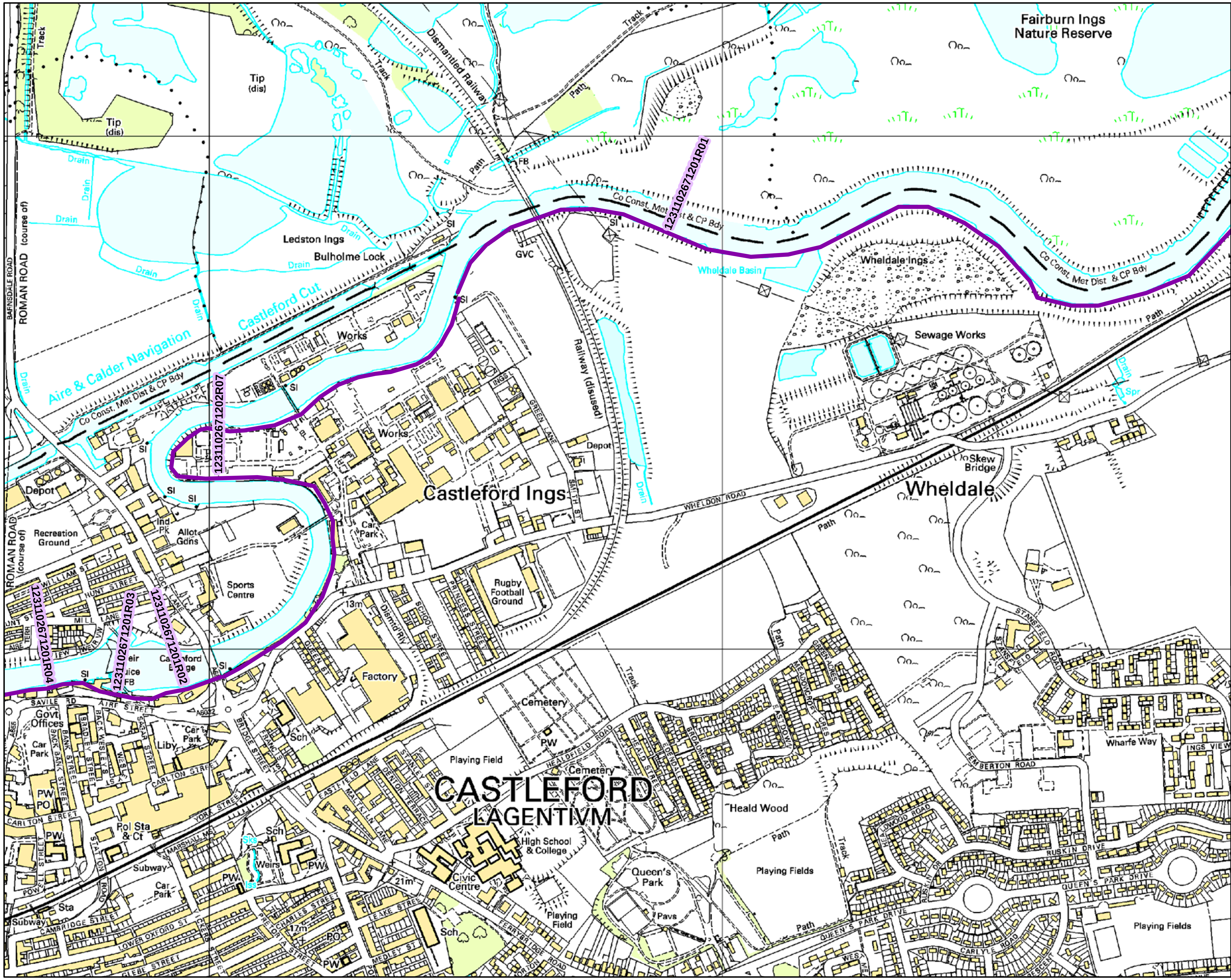
SCALE		DRAWN	
1:2500	AT A3	JW	
CHECKED		APPROVED	
RW		RW	

DRG SIZE	DATE	DRAWING NUMBER	REV
A3	23.06.12	CPPL-05/00-01	A

APPENDIX C

ENVIRONMENT AGENCY INFORMATION

Defence Location Map for Allerton Bywater - Date Created: 23/03/2012 [Ref: 21781]



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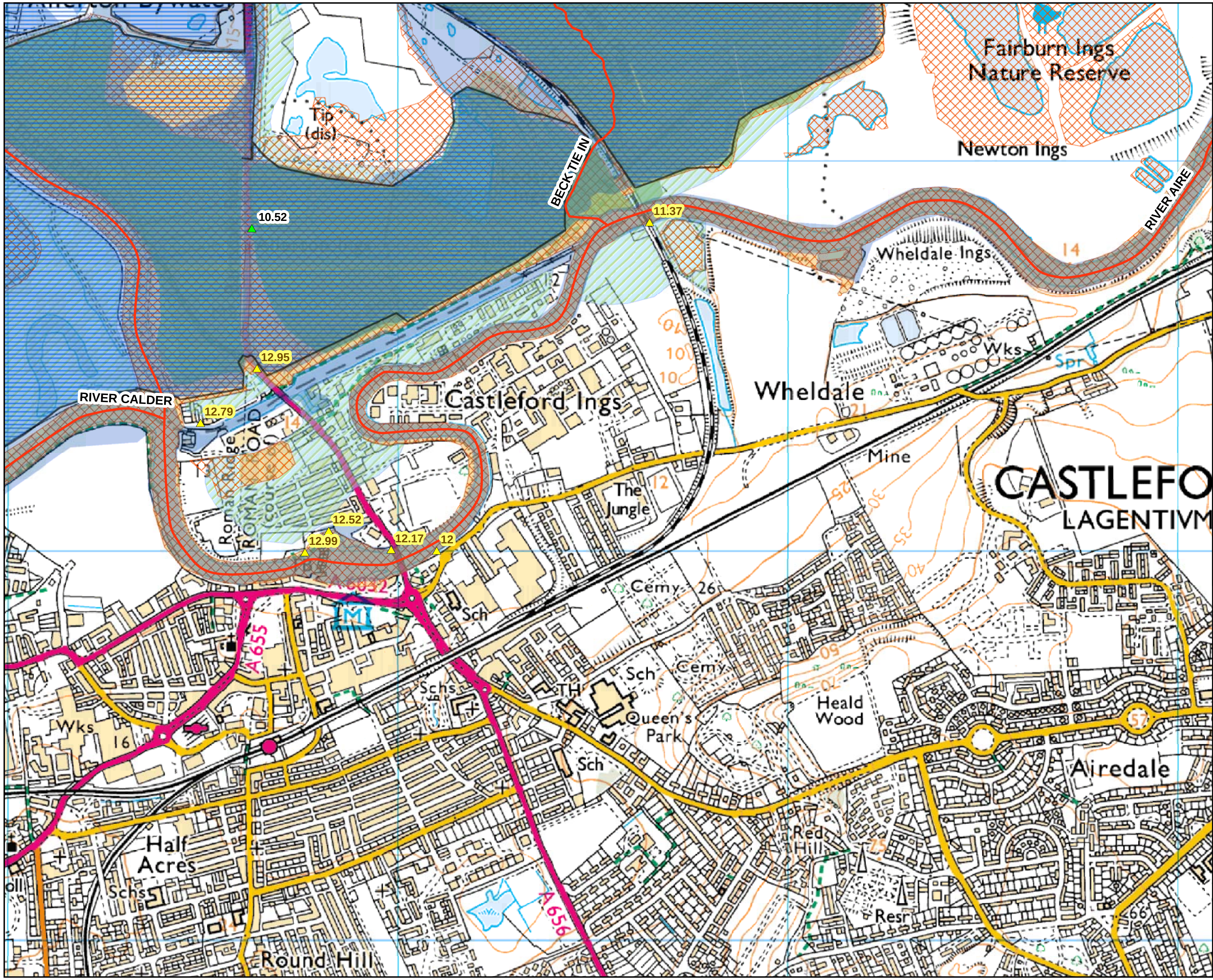
LEGEND

- Defences
- Main River

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Asset Reference	Asset Type	Asset Description	Asset Location	Bank	Maintainer	Design Standard	Overall Condition	Actual Upstream Crest Level	Actual Downstream Crest Level
1231102671202R07	raised defence (man-made)	Walled channel	Hicksons & Welch - no access	right	private	No Data	3	13.46	13.3
1231102671201R01	maintained channel	HIGH GROUND	Bulholme Lock to Fariburn Ings	right	private	100	2	No Data	No Data
1231102671201R02	raised defence (man-made)	MASONRY WALLs	U/s of Castleford Road Bridge - to the Weir and	right	private	100	2	No Data	13.88
1231102671201R03	raised defence (man-made)	MASONRY FLOODWALL	U/S OF CASTLEFORD BRIDGE - d/s of Weir	right	private	100	2	No Data	No Data
1231102671201R04	raised defence (man-made)	FLOODWALL AND BUILDINGS	U/S OF CASTLEFORD BRIDGE	right	Environment Agency	100	2	13.49	13.28

Flood History Map for Allerton Bywater - dated 23/03/2012 [Ref: 21781]



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N W E S

Flood Extents

Legend

- Feb 2002 Flood Event Flood Level (m)
- Autumn 2000 Flood Event Flood Level (m)
- Main River
- Jan 2008 Flood Event Flood Extent
- 2007 Flood Events Flood Extent
- Feb 2002 Flood Event Extent
- Autumn 2000 Flood Event Flood Extent
- 1995 Flood Event Flood Extent
- River Aire 1978 Flood Event Flood Extent

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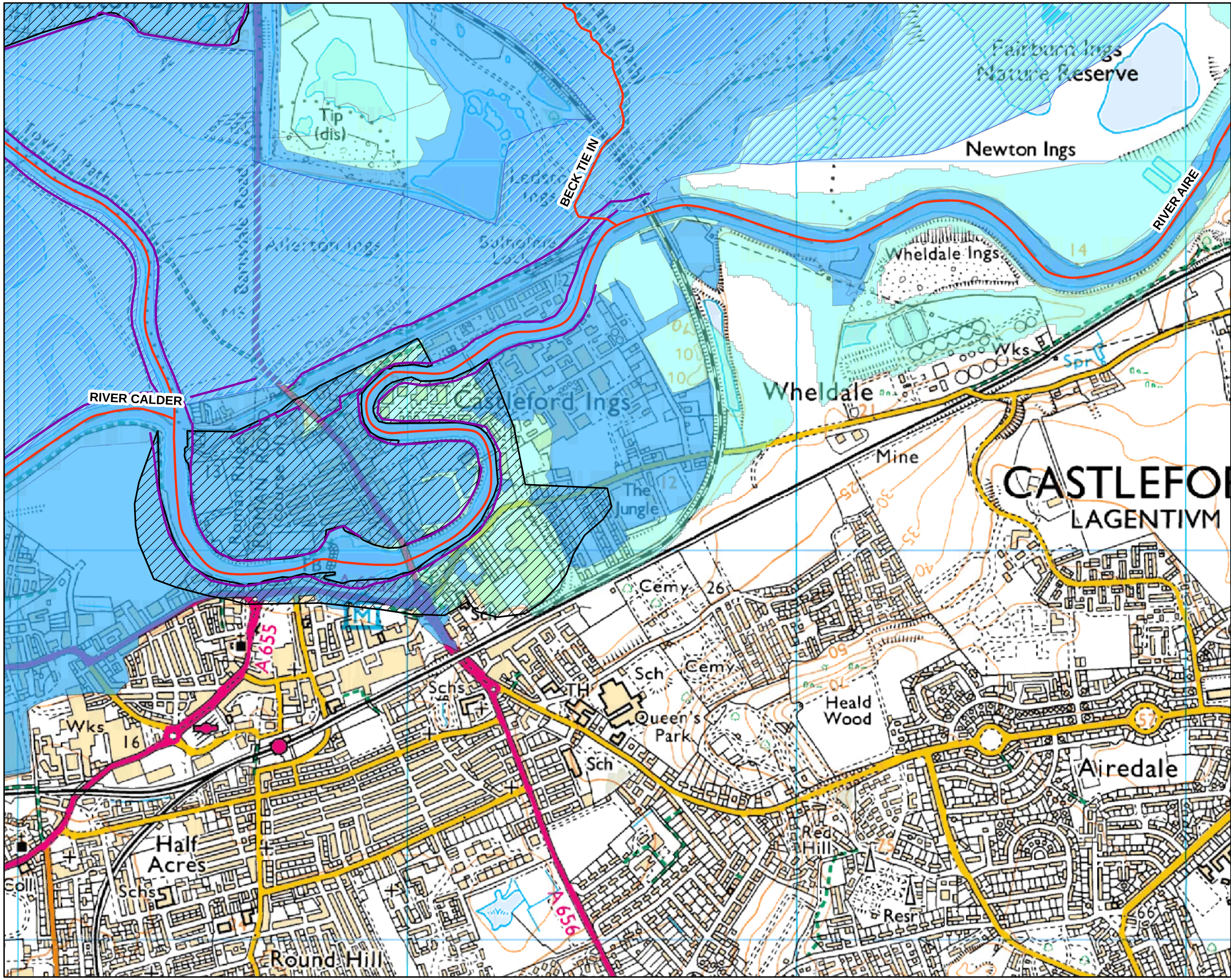
Flood Map for Allerton Bywater - Date Created: 23/03/2012 [Ref: 21781]



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LEGEND

- Main River
- Flood Map Flood Defences
- Flood Zone 2 (FZ2)
- Flood Zone 3 (FZ3)
- Areas Benefitting From Flood Defences
- Flood Storage Areas

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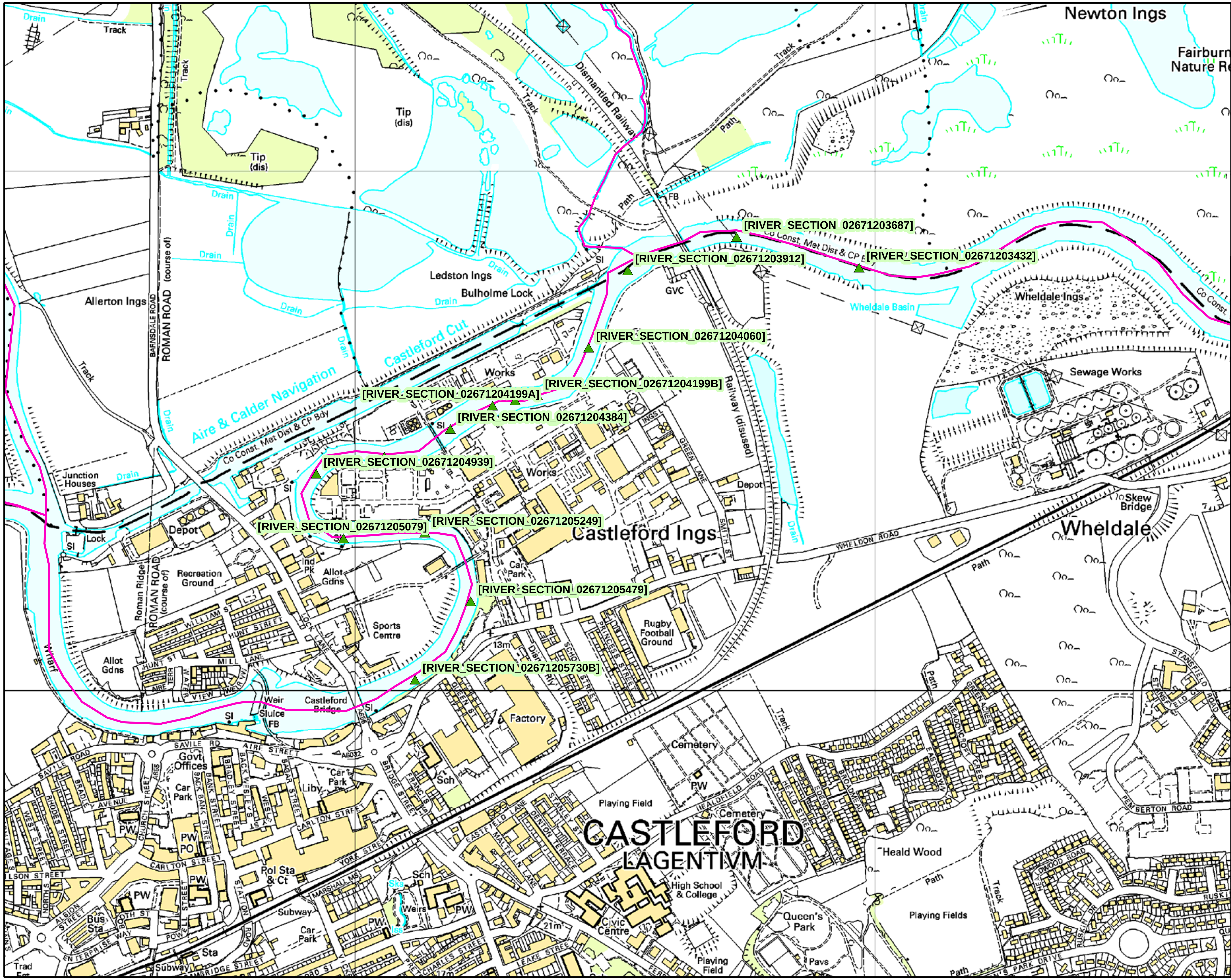
Model Node Point Location Map for Allerton Bywater - Date Created: 23/03/2012 [Ref: 21781]



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N W E S

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LEGEND

Node Points

Main River

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Client: Environment Agency North East Region
Project: Lower Aire model Update

Modified Middle Aire Model	Defended	Defended	Defended	Defended	Defended	Defended	Defended	Defended	Undefended
Node Label	Max Stage - 10yr	Max Stage - 25yr	Max Stage - 50yr	Max Flow - 100yr	Max Stage - 100yr	Max Stage - 100yrCC-2025	Max Stage - 200yr	Max Stage - 100yrCC-2115	Max Stage - 100yr
02671205730B	12.17	12.34	12.70	574.88	13.07	13.35	13.30		
2671205479	11.99	12.15	12.48	574.84	12.84	13.09	13.05	13.31	12.70
2671205249	11.96	12.11	12.43	574.82	12.77	13.01	12.97	13.21	12.64
2671205079	11.95	12.11	12.43	574.80	12.78	13.02	12.98	13.22	12.64
2671204939	11.87	12.02	12.33	574.79	12.66	12.89	12.85	13.08	12.52
2671204599	11.87	12.02	12.32	574.76	12.67	12.90	12.86	13.10	12.52
2671204384	11.83	11.97	12.27	574.72	12.60	12.83	12.79	13.01	12.45
02671204199A	11.84	11.99	12.29	574.70	12.63	12.86	12.82	13.05	12.48
02671204199B	11.84	11.99	12.29	579.55	12.63	12.86	12.82	13.05	12.48
2671204060	11.79	11.93	12.21	579.52	12.55	12.78	12.74	12.97	12.38
2671203912	11.77	11.91	12.18	579.50	12.50	12.71	12.68	12.90	12.34
2671203687	11.77	11.92	12.20	579.47	12.52	12.73	12.70	12.92	12.36
2671203432	11.75	11.89	12.17	579.45	12.48	12.69	12.66	12.88	12.32

100yr			100yrCC-2025		100yrCC-2115		PWL-Diff- 100yrCC2025 to100yr	PWL-Diff- 100yr CC2115 TO 100 yr
Label	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	(mm)	(mm)
2671205730B	574.877	13.069	639.13	13.352	697.145	13.591	283	522
2671205479	574.84	12.836	639.097	13.092	697.117	13.309	256	473
2671205249	574.818	12.772	639.072	13.01	697.094	13.207	238	435
2671205079	574.802	12.776	639.053	13.017	697.078	13.22	241	444
2671204939	574.787	12.663	639.036	12.889	697.067	13.079	226	416
2671204599	574.755	12.667	638.992	12.9	697.035	13.098	233	431
2671204384	574.72	12.601	638.961	12.825	697.013	13.013	224	412
2671204199A	574.695	12.628	638.949	12.857	696.993	13.052	229	424
2671204199B	579.55	12.628	644.008	12.857	702.217	13.052	229	424
2671204060	579.522	12.549	643.996	12.777	702.196	12.972	228	423
2671203912	579.497	12.499	643.986	12.714	702.18	12.898	215	399
2671203687	579.469	12.515	643.97	12.733	702.162	12.92	218	405
2671203432	579.449	12.48	643.948	12.694	702.139	12.877	214	397

Label	Max Flow	Max Stage	Max Flow	Max Stage	Diff (mm)
2671205730B	574.877	13.069	580.038	12.953	-116
2671205479	574.84	12.836	580.012	12.701	-135
2671205249	574.818	12.772	579.992	12.636	-136
2671205079	574.802	12.776	579.978	12.64	-136
2671204939	574.787	12.663	579.964	12.517	-146
2671204599	574.755	12.667	579.931	12.517	-150
2671204384	574.72	12.601	579.914	12.448	-153
2671204199A	574.695	12.628	579.898	12.475	-153
2671204199B	579.55	12.628	585	12.475	-153
2671204060	579.522	12.549	584.982	12.385	-164
2671203912	579.497	12.499	584.966	12.34	-159
2671203687	579.469	12.515	584.944	12.355	-160
2671203432	579.449	12.48	584.917	12.318	-162

APPENDIX D

EXISTING SURFACE WATER RUNOFF RATES

Pell Frischmann

Project/Calc No.	E57016/C001
Sheet No.	1 of 2
Date	28.3.12
By	HM
Chkd	

CALCULATIONS

Project: E57016 Allerton Bywater

Subject: To calculate the existing surface water runoff rates for the site in line with current guidance

Ref.

Output

Aim

To calculate existing surface water runoff rates for the site for a range of return periods

Methodology

The IH 124 Report was used to calculate the existing runoff rates as the site is predominately Greenfield for the purposes of drainage

The following parameters have been input into Micro Drainage:

Total Area = 5.3 ha		taken from client supplied information
Existing Impermeable Area =	0.36 ha	taken from client supplied info
Return Period (Years) =	100	taken from Technical Guidance to NPPF
SAAR =	602	selected within Micro Drainage
Soil =	0.45	selected within Micro Drainage
Growth Curve =	None	selected within Micro Drainage
Urban =	0.067	selected within Micro Drainage
Region =	Region 3	selected within Micro Drainage

The results are indicated in the table below

Return Period (Years)	1 in 1 year	1 in 30 years	1 in 100 years
Runoff Rate (l/s)	18.9	38.1	44.6

Form ref:

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	5.300	Urban	0.067
SAAR (mm)	602	Region Number	Region 3

Results	**l/s**
QBAR Rural	19.5
QBAR Urban	22.0
Q100 years	44.6
Q1 year	18.9
Q30 years	38.1
Q100 years	44.6

APPENDIX E

PROPOSED STORAGE DESIGN

Ref. | Output

Aim

To calculate the amount of storage required at the site to control the 1 in 100 year storm event plus an allowance of 20 % for climate change.

The following parameters were input into Micro Drainage:

Rainfall Model =	FEH	selected within Micro Drainage
Inflow =	Rainfall Data	selected within Micro Drainage
Additional Inflow =	None	selected within Micro Drainage
Return Period =	100 years	selected within Micro Drainage
Storage Structure =	Cellular Storage Structure	selected within Micro Drainage
Infiltration Coefficient Base (m/hr) =	0.1	selected within Micro Drainage
Infiltration Coefficient Side (m/hr) =	0.1	selected within Micro Drainage
Safety Factor =	2	selected within Micro Drainage
Porosity =	0.95	selected within Micro Drainage
Invert Level (m) =	1	selected within Micro Drainage
Cover Level (m) =	2	selected within Micro Drainage
Length (m) =	30	selected within Micro Drainage
Impermeable Area (ha) =	2.75	taken from drawing number SK001

An outline calculation in Micro Drainage indicates that approximately **1360 m^3** of storage is required to attenuate the 1 in 100 year plus 20 % allowance for climate change.
This is based on a plan area of **1440 m^2** using a conservative estimate of infiltration

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 542 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	1.552	0.552	21.2	755.3	O K
30 min Summer	1.635	0.635	21.3	868.9	O K
60 min Summer	1.721	0.721	21.5	986.9	Flood Risk
120 min Summer	1.801	0.801	21.7	1096.3	Flood Risk
180 min Summer	1.837	0.837	21.8	1144.8	Flood Risk
240 min Summer	1.852	0.852	21.8	1165.8	Flood Risk
360 min Summer	1.853	0.853	21.8	1166.3	Flood Risk
480 min Summer	1.835	0.835	21.8	1141.7	Flood Risk
600 min Summer	1.816	0.816	21.7	1116.3	Flood Risk
720 min Summer	1.798	0.798	21.7	1091.2	Flood Risk
960 min Summer	1.778	0.778	21.6	1064.6	Flood Risk
1440 min Summer	1.735	0.735	21.5	1005.4	Flood Risk
2160 min Summer	1.664	0.664	21.4	908.6	O K
2880 min Summer	1.591	0.591	21.2	809.0	O K
4320 min Summer	1.399	0.399	20.8	546.3	O K
5760 min Summer	1.255	0.255	20.5	348.4	O K
7200 min Summer	1.153	0.153	20.3	208.6	O K
8640 min Summer	1.087	0.087	20.2	118.7	O K
10080 min Summer	1.054	0.054	20.1	73.4	O K
15 min Winter	1.620	0.620	21.3	848.0	O K
30 min Winter	1.715	0.715	21.5	978.0	Flood Risk
60 min Winter	1.815	0.815	21.7	1114.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	150.190	0.0	19
30 min Summer	87.745	0.0	33
60 min Summer	51.263	0.0	64
120 min Summer	29.949	0.0	122
180 min Summer	21.870	0.0	182
240 min Summer	17.497	0.0	242
360 min Summer	12.777	0.0	360
480 min Summer	10.222	0.0	430
600 min Summer	8.598	0.0	490
720 min Summer	7.465	0.0	554
960 min Summer	6.052	0.0	684
1440 min Summer	4.502	0.0	964
2160 min Summer	3.350	0.0	1364
2880 min Summer	2.716	0.0	1764
4320 min Summer	1.916	0.0	2512
5760 min Summer	1.496	0.0	3232
7200 min Summer	1.234	0.0	3888
8640 min Summer	1.055	0.0	4504
10080 min Summer	0.924	0.0	5144
15 min Winter	150.190	0.0	19
30 min Winter	87.745	0.0	33
60 min Winter	51.263	0.0	62

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
120 min Winter	1.911	0.911	21.9	1245.9	Flood Risk
180 min Winter	1.957	0.957	22.0	1309.2	Flood Risk
240 min Winter	1.981	0.981	22.1	1341.8	Flood Risk
360 min Winter	1.994	0.994	22.1	1360.4	Flood Risk
480 min Winter	1.984	0.984	22.1	1345.9	Flood Risk
600 min Winter	1.961	0.961	22.0	1314.7	Flood Risk
720 min Winter	1.935	0.935	22.0	1278.5	Flood Risk
960 min Winter	1.908	0.908	21.9	1241.7	Flood Risk
1440 min Winter	1.839	0.839	21.8	1148.3	Flood Risk
2160 min Winter	1.723	0.723	21.5	989.5	Flood Risk
2880 min Winter	1.606	0.606	21.3	829.3	O K
4320 min Winter	1.329	0.329	20.7	450.6	O K
5760 min Winter	1.138	0.138	20.3	189.1	O K
7200 min Winter	1.050	0.050	20.0	67.8	O K
8640 min Winter	1.043	0.043	17.2	58.2	O K
10080 min Winter	1.037	0.037	15.0	50.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
120 min Winter	29.949	0.0	120
180 min Winter	21.870	0.0	178
240 min Winter	17.497	0.0	236
360 min Winter	12.777	0.0	350
480 min Winter	10.222	0.0	458
600 min Winter	8.598	0.0	560
720 min Winter	7.465	0.0	590
960 min Winter	6.052	0.0	738
1440 min Winter	4.502	0.0	1042
2160 min Winter	3.350	0.0	1492
2880 min Winter	2.716	0.0	1904
4320 min Winter	1.916	0.0	2640
5760 min Winter	1.496	0.0	3288
7200 min Winter	1.234	0.0	3672
8640 min Winter	1.055	0.0	4392
10080 min Winter	0.924	0.0	5136

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 443400 426600 SE 43400 26600
C (1km)	-0.024
D1 (1km)	0.335
D2 (1km)	0.381
D3 (1km)	0.250
E (1km)	0.296
F (1km)	2.393
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+20

Time Area Diagram

Total Area (ha) 2.750

Time From:	**(mins) To:**	**Area (ha)**
0	4	2.750

Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 1.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.10000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.10000

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	1440.0	1440.0	0.600	1440.0	1531.1
0.100	1440.0	1455.2	0.700	1440.0	1546.3
0.200	1440.0	1470.4	0.800	1440.0	1561.4
0.300	1440.0	1485.5	0.900	1440.0	1576.6
0.400	1440.0	1500.7	1.000	1440.0	1591.8
0.500	1440.0	1515.9			

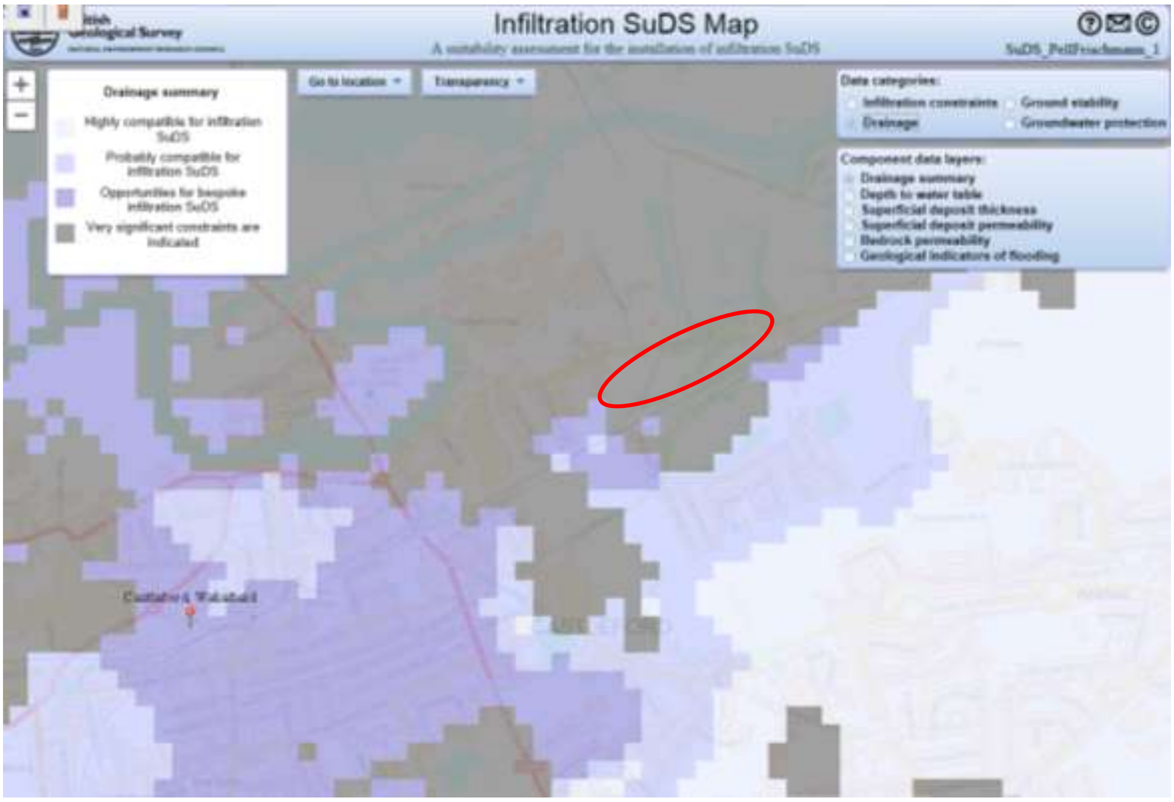
APPENDIX F

BRITISH GEOLOGICAL SURVEY
SUDS INFILTRATION MAP

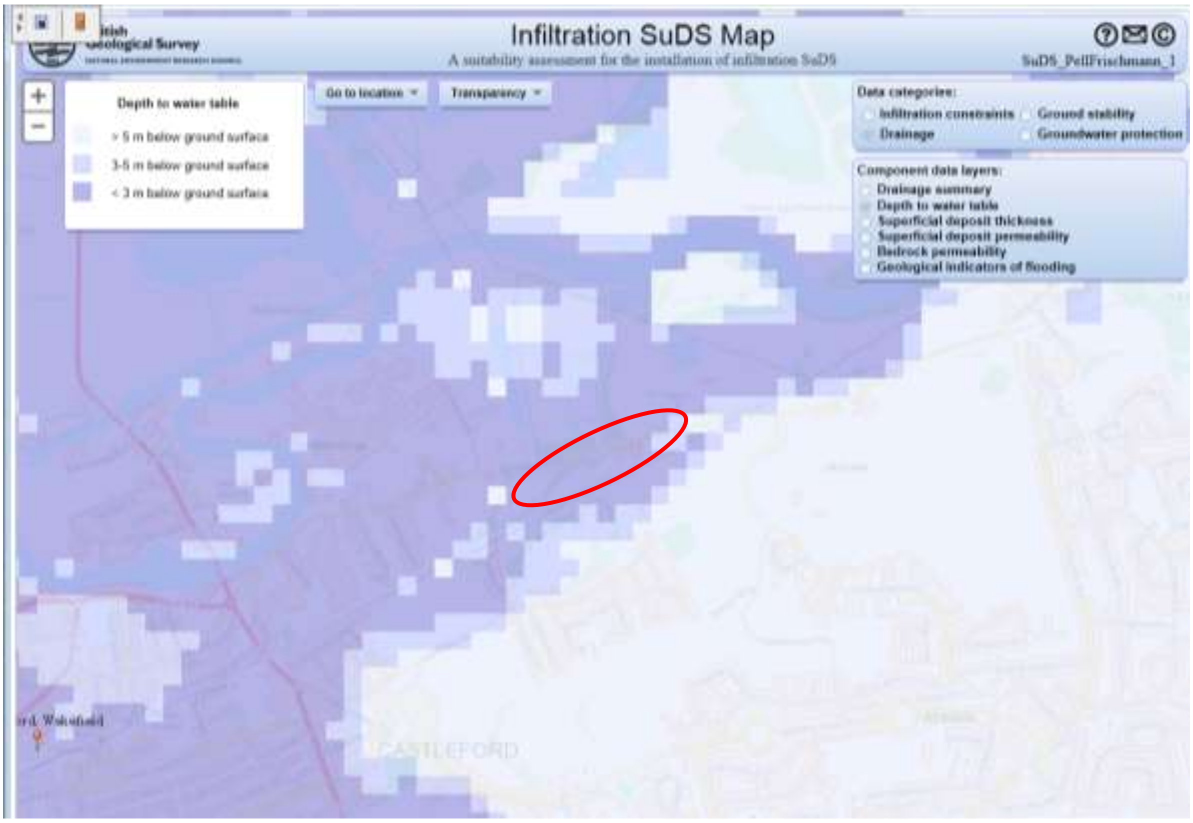
British Geological Society Infiltration SuDS Map

Wheldon, Castleford

Drainage Summary Map



Depth To Water Table



11. NOISE AND VIBRATION

11.1 INTRODUCTION

11.1.1 This chapter of the ES assesses the likely significant effects of the Proposed Development in terms of Noise and Vibration.

11.1.2 This chapter describes the assessment methodology; the baseline conditions at the Site and surroundings; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after the measures have been employed.

11.1.3 This chapter does not assess the operational noise and vibration impacts from the proposed on-site rail terminal – but does consider impacts from its construction.

11.2 PLANNING POLICY CONTEXT

National Policy

National Planning Policy Framework

11.2.1 The National Planning Policy Framework (March 2012) states that:

"The planning system should contribute to and enhance the natural and local environment by:

preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;"

Local Policy – Wakefield Council Local Development Framework Core Strategy

11.2.2 The Core Strategy document has the following Policies relevant to managing and controlling development with respect to Noise effects:

Policy D20 - Pollution Control

"…In determining proposals particular consideration will be given to:

- *an appropriate impact assessment is submitted with the planning application; and*
- *approved mitigation measures are carried out prior to occupation or operation of the development commencing."*

Noise Pollution

When considering a proposal for development the presence of noise generating uses close to the Site, and the potential noise generated by the proposal will be taken into account. Some uses are particularly sensitive to noise. Examples include housing, educational establishments, care establishments such as hospitals and nursing homes, public buildings such as libraries and museums, and offices. Planning conditions and/or legal agreements may be used to control the impact of noise in relation to the proposed development or to the benefit of the wider community.

Highways, railways and aircraft are a major source of noise nuisance. Noise generated may vary at different times, and there are maximum levels set out in government regulations that are considered to be reasonable. Measures can sometimes be incorporated into development to reduce noise to acceptable limits. Buildings can be sited away from the noise and constructed with materials that reduce noise. Externally recreation areas and gardens can be sited away from highways, and protected by planting, mounding or fencing. Where a development proposal is acceptable in principle, and appropriate noise reduction measures are incorporated to achieve an acceptable degree of amenity for occupiers, permission may be granted. However, sites that are adjacent to existing noisy transport uses will generally not be acceptable for noise sensitive development.

Proposals for industrial development or other uses which have implications for generating noise will be assessed on their circumstances. Locational characteristics will be taken into account and consideration given to appropriate noise reduction. The applicant will be required to demonstrate that the development is constructed to a standard and/or incorporates noise reduction measures which will ensure that the resulting noise levels at specified locations will not exceed acceptable maximum levels."

Policy W6 - Assessing Applications for Waste Management Facilities

"Proposals for waste management facilities will be permitted where it can be demonstrated that:

- *there would be no unacceptable adverse environmental, social or economic effects, particularly in relation to urban regeneration, economic development, environmental improvement, and growth priorities;*

- *adequate means of controlling noise, dust, litter, odours, vermin and other emissions are incorporated in the scheme, such that there would be no unacceptable adverse effects on the amenity of sensitive receptors;*

Planning conditions and, where necessary, legal agreements will be used as appropriate to ensure mitigation measures are put in place to manage any effects *associated with traffic, noise, odour, visual impact, flooding, dust, air quality and other potential effects."*

Policy D9 - Design of New Development

"….In particular proposals shall:

- *have no significant detrimental impact on the amenity of neighbouring users or residents and existing or prospective users;"*

Policy CS 10 - Design, Safety and Environmental Quality

"…In all parts of the district, new development will:

- *minimise the risk from all forms of pollution and contamination for existing and future occupants, the wider community and the environment,…"*

11.3 ASSESSMENT METHODOLOGY

Noise

11.3.1 Unless specified otherwise within this chapter, as human perception to noise is subjective, the most appropriate assessment of the effect of the Proposed Development on the noise climate is undertaken through reference to the methodology detailed within the Guidelines for Noise Impact Assessment. The guidance indicates broad parameters with respect to the magnitude of the basic noise change as detailed in Table 11.1 below. A flexible approach to these categories should take into consideration site specific components of the scheme with the potential for the alteration of the magnitude attributed to the presented noise levels.

11.3.2 The guidance stipulates that the noise level categories should not be used strictly to define the description of the noise change as there is no simple formulaic approach for relating noise change to a verbal description such as 'slight' or 'moderate'. However, it is considered using these criteria will be an acceptable approximation of the effect magnitude. It should be noted that further information relating to the duration and type of works is presented in conjunction with the broad effect criteria and where the assessor's professional judgement has been used to determine the effect significance, this has been referenced accordingly.

Table 11.1: Broad methodology for predicting the magnitude of effects on noise

Sensitivity	Broad Categories of Effect Magnitude
0	Negligible
0.1 – 2.9	Slight Effect
3.0 – 4.9	Moderate Effect
5.0 and more	Substantial Effect

11.3.3 British Standard 4142:1997 Method for rating industrial noise affecting mixed residential and industrial areas is also utilised within the assessment.

11.3.4 Further to the above, Tables 11.2 and 11.3 below present the methodology of the predicted effect magnitude associated with road traffic noise following the guidance presented within DMRB.

Table 11.2: Methodology for predicting the scale (magnitude) of effects of road traffic noise in the short term

Noise Level Change	Magnitude of Effect	Categories of Effect Magnitude
0	No change	Negligible
0.1 – 0.9	Negligible	Negligible
1 – 2.9	Minor	Slight Effect
3.0 – 4.9	Moderate	Moderate Effect
5.0 and more	Major	Substantial Effect

Table 11.3: Methodology for predicting the scale (magnitude) of effects of road traffic noise in the long term

Noise Level Change	Magnitude of Effect	Categories of Effect Magnitude
0	No change	Negligible
0.1 – 2.9	Negligible	Negligible
3.0 – 4.9	Minor	Slight Effect
5.0 – 9.9	Moderate	Moderate Effect
10.0 and more	Major	Substantial Effect

11.3.5 Receptors to noise generally include individual or groups of residential properties, hospitals, schools, and public outdoor locations, including parks and playing fields. Table 11.4 provides examples of the different sensitivities which can be assigned to different receptors.

Table 11.4: Methodology for Assessing Sensitivity of Noise and Vibration

Sensitivity	Example of Receptor
Very High	International / Nationally Important: World Heritage Site
High	Regionally / Nationally Important: SSSI (Designated for Birds)
Medium	County Importance: e.g. Cities, town, nature reserve designated for birds
Low	Local / Borough Importance: e.g. Villages, single properties or group of properties

11.3.6 It may be counter-intuitive to consider individual properties or small groups of properties to be of Low sensitivity but this approach considers the impacts of the proposed scheme at a local, national and internation level. In general, local impacts are considered to be of Low sensitivity. In fact, the outcome in terms of the EIA is that noise impacts on individual properties have been taken into account and assessed accordingly.

Table 11.5: Significance of Effects Matrix

Sensitivity of Receptor	Magnitude of Effect			
	Substantial Effect	Moderate Effect	Slight Effect	Negligible Effect
Very High	Major	Major – Moderate	Moderate	Minor
High	Major – Moderate	Moderate	Moderate – Minor	Neutral
Medium	Moderate	Moderate	Minor	Neutral
Low	Moderate – Minor	Minor	Minor – Neutral	Neutral

11.3.7 The overall significance of the effect on a sensitive receptor is determined by combining the characteristics in Tables 11.1 /11.2/11.3 and 11.4 using the matrix in Table 11.5. As human perception to noise is subjective, it is considered that where a residual effect is predicted by this approach to be of minor significance or above, this is classified as a significant effect, in EIA terms and is assessed accordingly.

Vibration

11.3.8 Reference is made to BS 5228 (Part 4) with regard to assessing the potential effect during the construction phase. Due to the nature of this type of effect – i.e. unknown ground conditions between the Proposed Development and nearby sensitive receptors - for the purpose of this assessment, the potential vibration effect will be considered to either be negligible or substantial.

11.3.9 As with noise affect the sensitivity of the receptor will be combined with the magnitude of change to determine the overall significance of effect, in accordance with Table 11.5.

11.3.10 A predicted residual vibration effect which is of moderate – minor significance is classified as a significant effect, in EIA terms.

11.4 BASELINE CONDITIONS

11.4.1 The proposed Site is currently unused land. The Site is bounded to the north by Wheldon Road, to the east by an energy centre, to the west by open ground and beyond the Castleford Tigers Stadium and a row of terraced houses and to the south by a railway line. The area around the Site is of mixed use with open land to the north, industrial, commercial and residential properties to the west and residential properties to the south across the railway line.

11.4.2 The noise climate at the Site was found to be dominated by noise from road traffic on Wheldon Road to the north with occasional train noise from the railway line to the south.

11.4.3 The nearest existing sensitive receptors with regard to the Proposed Development are residential premises on Wheldon Road to the west, a possible travellers site across Wheldon Road to the north and new residential properties off Healdfield Road (Clarity Development) across the railway line to the south. Residential premises are also located, more distantly from the Site, along Healdfield Road to the south. Commercial premises are considered to be of far less sensitivity than residential properties.

11.4.4 A summary of the existing noise sources at the properties on Wheldon Road is outlined below:

- Residents vehicle movements;
- Road traffic noise from Wheldon Road;
- Noise from trains passing along the railway line; and,
- Noise from the adjacent industrial and commercial premises.

11.4.5 A summary of the existing noise sources at the possible traveller's site is outlined below:

- Road traffic noise from Wheldon Road; and,
- Occasional distant noise from the industrial and commercial premises on Wheldon Road to the east.

11.4.6 A summary of the existing noise sources at the Clarity Development on Healdfield Road is outlined below:

- Road traffic noise from Healdfield Road;
- Industrial noise from the nearby industrial premises; and,
- Noise from trains passing by on the railway line to the north.

11.4.7 During the night-time noise monitoring survey, existing noise sources observed at the measurement locations included:

- Road traffic noise on Wheldon Road (properties on Wheldon Road/Princess Street and travellers site) and Healdfield Road (Clarity Development);

- Infrequent rail traffic noise; and,
- At Wheldon Road/Princess Street occasional industrial noise from the adjacent industrial premises.

11.4.8 Further afield, receptors will include additional residential properties, commercial properties and other sensitive land-uses along the roads used to access the Site during both the construction and operational phases.

11.4.9 In accordance with the guidance provided in Section 11.3.4 the residential and commercial receptors are considered to be of low sensitivity.

11.4.10 Based on the above noise monitoring was undertaken at the following locations:

Location 1 – At the nearest residential property on Wheldon Road (daytime and night-time);

Location 2 – At the southern boundary of the cemetery on Healdfield Road (daytime);

Location 3 – Within the Clarity Development (night-time); and

Location 4 – On land adjacent to Wheldon Road in the approximate location of the travellers' site (daytime and night-time).

11.4.11 Noise monitoring was undertaken at Location 2 in order to provide representative daytime noise levels at the adjacent Clarity development without the influence of the ongoing construction noise.

11.4.12 A noise monitoring location plan is presented in Figure 11.1 which is included in the appendices to this chapter.

Existing Noise Levels

11.4.13 Tables 11.6 and 11.7 summarise the results of the daytime and night-time noise monitoring surveys. A full set of the noise monitoring survey data is included as Appendix 11.1.

Table 11.6: Daytime noise levels

Location	Date/Time	Average L_{Aeq} (dB)	Average of the L_{A90} (dB)	Comments
1	14/03/2012 14:23 - 15:01	50.4	44.8	Road traffic noise from Wheldon Road; Noise from the adjacent industrial/ commercial premises was significant, raising the background levels.

2	21/03/2012 11:28 - 13:28	38.6	32.7	Road traffic noise from Healdfield Road; Occasional trains passing
3	n/a	n/a	n/a	n/a
4	21/03/2012 09:57 - 10:57	51.4	33.9	Road traffic noise from Wheldon Road; Distant, occasional industrial/commercial noise

Table 11.7: Night-time noise levels

Location	Time	Average L_{Aeq} (dB)	Average of the L_{A90} (dB)	Comments
1	15/03/12 00:27 - 01:12	47.7	39.5	Road traffic noise from Wheldon Road; Distant industrial noise (fans etc.)
2	n/a	n/a	n/a	n/a
3	21/03/12 23:37 - 23:57	32.9	31.5	Occasional vehicles passing on Healdfield Road
4	20/06/12 23:10 - 23:30	44.8	32.6	Road traffic noise from Wheldon Road; Distant industrial noise (fans etc.)

Sources of Vibration

11.4.14 There are no significant sources of vibration located within close proximity of the proposed Site.

11.5 POTENTIAL SIGNIFICANT EFFECTS

Construction Effects

<u>Noise</u>

11.5.1 The most notable effects due to increases in noise and vibration during construction will be during periods of earthworks, construction of site infrastructure and any piling activities. In addition to on-site sources, increased effects may be caused by HGV movements travelling to and from the Site.

11.5.2 Activities associated with the construction phase that have been assessed have been assumed to comprise the following:

- General site clearance;
- Excavation of material, if necessary, to remove unsuitable areas with respect to final end-use;
- Movement of construction equipment and plant;
- Export and import of materials;

- Excavation, movement and grading of material on site to facilitate suitable ground conditions for the installation of below ground level services, construction of the foundations for buildings and associated infrastructure;
- Compaction of material to create suitable ground conditions;
- Concreting works to create the foundations;
- The potential that piling will be undertaken during the construction works;
- Activities associated with the erection of buildings; and
- Highway and infrastructure improvements.

11.5.3 Exact details regarding the construction techniques and types of plant can only be estimated at present and therefore it is difficult to predict accurately the potential magnitude of potential noise effects on local receptors. Therefore, the potential effect of construction noise is assessed qualitatively.

11.5.4 It is appreciated that during certain periods of the construction phase the effect will be **substantial** in magnitude at the nearby sensitive residential and commercial receptors which have a low sensitivity. The effect will be **negative, direct, temporary and short-term**. The unmitigated effect significance is considered to be **moderate – minor adverse** in scale, in accordance with the stated assessment methodology. However, effects will reduce to a **negligible** magnitude depending on the location of the construction activities on a daily basis in the Site area, with noise levels being attenuated as the distance between source and receptor increases and the equipment being used varies. This will result in a **neutral** effect in scale for certain periods of the working day.

11.5.5 Overall effects to local residential receptors during the construction phase are expected to be temporary and relatively short term in duration and it is anticipated that compliance with the additional mitigation measures identified below will reduce this effect.

11.5.6 As very limited data is available for the construction noise assessment confidence in the prediction is low. However, the qualitative assessment has produced an impact that is substantial in magnitude and so the assessment represents a conservative approach.

Construction Traffic Noise

11.5.7 In addition to the on-site sources mentioned, increased noise may be caused by HGV movements and from site workers travelling to and from the Site during the construction period.

11.5.8 During the construction works the number of vehicles used during site preparation and construction will vary over each phase. The Site entrance will be from

Wheldon Road. The nearest sensitive receptors are located at the possible traveller's site on Wheldon Road at a distance of approximately 60m from the Site access.

11.5.9 It is considered that the worst-case scenario effect during the daytime at the above location will be **substantial** in magnitude with the effect being **negative, direct, temporary** and **short-term** for certain periods of the day. The unmitigated effect significance is considered to be **moderate – minor adverse**. However, it is considered that the overall effect will be **negligible** and significance **neutral** as the movements will be spread over the working day and will be for a short time period. Mitigation measures to minimise the potential noise effect are presented below.

11.5.10 As the assessment has been undertaken qualitatively due to the unknown number of proposed construction vehicle movements confidence in the prediction is low.

Vibration

11.5.11 The magnitude of vibrations from activities such as piling to support foundations diminishes exponentially and rapidly with increasing distance from the source. The highest energy piling operations are considered unlikely to unduly disturb people should they occur at a distance of more than 100m. Given that the nearest existing residential property is more than 130m away from the nearest proposed building on the Site the potential for vibration from construction operations is considered minimal and it is considered that there will be a **negligible** effect relating to human response with a **neutral** significance.

11.5.12 As the assessment of the potential vibration effects of the scheme has been undertaken qualitatively, due to unknown variables with regard to the intervening ground conditions between the Site and sensitive receptors and the proposed location of any piling, confidence in the prediction is low.

Operational Effects

Noise

11.5.13 There is the potential for noise from the Proposed Development, once it becomes operational, to effect on nearby sensitive receptors. Consideration has been given to operational noise effects during the outline design stage, however these effects on existing noise sensitive receptors will be considered further during the detailed design stage following the findings of this assessment.

11.5.14 The potential noise sources to be considered comprise:

- Noise from operations/plant external to the main building
- Noise from operations/plant within the main building; and
- Noise from deliveries.

Operations/plant external to the main building

11.5.15 With reference to drawing CPPL-05/10-01 produced by Entran Architects and to Section 5 the main fixed noise sources external to the main building are:

- Pyrolysis stack (approx. 26.77 m high)
- Engine stacks (3no. at 26.77 m high)
- Gas flue stack (26.77 m high)

11.5.16 Anaerobic digestion is essentially a silent process so no contribution from the anaerobic digesters is anticipated.

11.5.17 The gas house is a fully enclosed and attenuated building so noise issues are not anticipated.

11.5.18 Given the distances between the noise sources and the receptors it can be assumed that they act as point sources for the purposes of the calculations.

Operations/plant within the main building

11.5.19 With reference to Section 5 the internal operations are divided between four zones within the building:

- Waste reception
- Autoclaving
- Pyrolysis
- Energy generation

11.5.20 The plant items/operations present within each of these four zones are also taken from Section 5.

11.5.21 Each of these zones is assumed to be a separate area source for the purposes of the calculations.

Deliveries

11.5.22 Pell Frischmann has provided traffic data for the operational phase of the Proposed Development which indicates that 135 waste delivery/collection trips will be undertaken each day. The assumptions within the traffic data are that the deliveries will take place within a 12hr (7am – 7pm) day Monday to Friday with a half day (7am to 1pm) on Saturday. Therefore approximately 11.25 vehicles per hour visit the Proposed Development to either deliver waste or collect bi-products. It is anticipated that there will be a weighting of these vehicles in the afternoon period and therefore the calculations will use a figure of 20 vehicles per hour to represent the peak operation.

11.5.23 For the purposes of assessing a number of discrete events such as refuse collection vehicles arriving and loading/unloading it is appropriate to use the Single Event Levels of each of these activities and to calculate from these, by using the frequency of these activities, the equivalent $L_{Aeq,1hr}$ for use in the assessment. A Single Event Level (SEL) is the L_{Aeq} of an activity corrected to a time period of 1 second and represents the equivalent noise level of that activity if all of the sound energy was released in one second.

11.5.24 As vehicles will travel along the Site access road the distance between the source and receptor will vary – an average distance has been assigned within the calculations.

Combined Operational Noise

11.5.25 The methodology of British Standard BS 4142: Method for rating industrial noise affecting mixed residential and industrial areas has been used in part, along with reference to Table 11.1, to assess the effect of operational noise sources from the Proposed Development. Due to the potential character of the noise (e.g. hums, bangs, etc.) a character correction of 5 dB has been added to each calculated noise level.

11.5.26 The night-time predicted noise levels do not include contributions from deliveries as deliveries will take place during daytime only as detailed in the Transport and Access Chapter.

11.5.27 The noise levels at each sensitive receptor from each of the sources mentioned above has been added together to give an overall noise level due to operational activities at the Proposed Development.

11.5.28 Details of the calculations, assumptions and the data used are contained within Technical Appendix 11.2.

11.5.29 The predicted overall daytime and night-time operational noise levels at each of the receptors are described in Tables 11.8 and 11.9 below:

Table 11.8 – Daytime operational noise levels at nearby sensitive receptors

Location	Combined noise level with character correction (dB(A))	Background daytime noise level (L_{A90} dB(A))	Predicted difference
Wheldon Road	39.5	44.8	-5.3
Clarity	36.6	32.7	3.9
Travellers	43.3	33.9	9.4

Table 11.9 – Night time operational noise levels at nearby sensitive receptors

Location	Combined noise level with character correction (dB(A))	Background night time noise level (L_{A90} dB(A))	Predicted difference
Wheldon Road	38	39.5	-1.5
Clarity	35.7	31.5	4.2
Travellers	41.6	32.6	9

11.5.30 Table 11.8 shows the difference between the predicted noise levels from operational noise sources and existing background noise levels at those sensitive receptors likely to experience effects from operational noise. During the daytime the specific noise level is less than 10 dB above the prevailing background noise level which will suggest that the likelihood of complaints is of above marginal significance according to BS 4142. At 10 dB and more above background complaints are likely. With reference to Table 11.1 the daytime effect magnitude will range between **negligible** and **substantial** with a **moderate/minor-neutral** significance. The effects are **direct** and **permanent**.

11.5.31 With reference to Table 11.9, at night-time the specific noise level is again less than 5 dB above the lowest background level at these receptors indicating that the likelihood of complaints is of marginal significance according to BS 4142. With reference to Table 11.1 the night-time effect will range between **negligible** and **substantial** with a **moderate/minor-neutral** significance. The effects again are **direct** and **permanent**.

11.5.32 Mitigation will be required in order to reduce the effect at the nearest sensitive receptors and this is discussed in Section 11.6 of this chapter.

Road Traffic Noise

11.5.6 A further potential effect from the Proposed Development which needs considering is the noise effect resulting from increases in road traffic movements along existing traffic routes. In order to bring about perceptible changes in noise levels, relatively sizeable changes in traffic levels are required according to the DMRB method which states that a change in noise level of 1dB (A) will be produced by a change in traffic flow of approximately 25%. A change in noise level of less than 1 dB (A) is barely perceptible and therefore it is considered that such a level change will constitute a negligible effect with respect to road traffic noise.

11.5.7 For each link in the road traffic model for the local road network the flow with and without the Proposed Development were compared for the opening year (2015). It was found that links in the local road network experienced increases in traffic flows of between 0.2% and 5.9% which suggests that, with reference to Table 11.1, the effect of changes in road traffic noise on the local road network as a result of the Proposed Development is **negligible** at all locations.

Vibration

11.5.8 It is considered that there will be no significant sources of vibration present during the operational phase of the Proposed Development. Therefore, the effect will be **negligible** in magnitude and **neutral** in significance.

11.5.9 Confidence in the prediction is high.

11.6 MITIGATION

Construction

11.6.1 Construction works will usually be subject to control by planning conditions and the following points should be considered reasonable to control and minimise noise effects from such associated activities. These points are to be included within a Construction Environmental Management Plan for the scheme as they represent 'Best Practicable Means' that should be employed to minimise construction and demolition effects. These measures have been included as an example of suitable mitigation measures and should not be regarded as an exhaustive list.

- Careful selection of working methods and programme;
- Consultation with the Local Authority regarding construction traffic routes;
- Selection of quietest working equipment available (e.g. electric/battery powered equipment which is generally quieter than petrol/diesel powered equipment);
- Positioning equipment behind physical barriers, i.e. existing features, hoarding, etc., or provision of lined and sealed acoustic covers for equipment that could potentially contribute to a noise nuisance;
- Directing noise emissions away from plant including exhausts or engines away from sensitive locations;
- Ensuring that regularly maintained and appropriately silenced equipment is used;
- Shutting down equipment when not in use, i.e. maintain a 'no idling policy';
- Handling all materials in a manner which minimises noise;
- If piling is undertaken, methods which minimise noise and vibration should be selected by the contractor.
- Switch all audible warning systems to the minimum setting required by the Health and Safety Executive;

- Restricting hours of site operation to the hours defined in Section 3.3.3;

- Employ best practices and follow guidance of British Standard 5228, Code of Practice for Noise Control on Construction and Open Sites (Parts 1 & 2) 1997; and

- If it is necessary to operate equipment outside normal working hours or a significant noise effect is anticipated then the Best Practicable Means as defined under Section 72 of the Control of Pollution Act 1974 will be employed to minimise noise from such equipment.

- The Local Authority is provided with powers under the Control of Pollution Act to control noise and vibration from construction sites including, if necessary, serving notices under Section 60.

Operation

11.6.2 Without mitigation the Proposed Development has the potential to cause effects of moderate significance at the nearest sensitive receptor. Consideration will, therefore, be given within the design to the following mitigation measures with regard to noise:

- Internal noise – acoustic enclosures for specific plant items, absorptive material on the walls/ceiling to reduce reverberant sound within the buildings. Attenuation will be chosen to reduce the noise level within each area of the building to below 78 dB(A).

- Stacks – in-stack noise attenuators which reduce the in-stack noise level to below 70 dB (A);

- Noise barriers – noise barriers will be installed along the inward access road. The barriers will provide screening of the waste reception area for all receptors and will therefore need to run from the Site entrance along the access road and around the waste reception area. The barrier will be 3m in height to account for the height of noise sources (e.g. refuse vehicles). The design of the barriers can be finalised during the detailed design stage to ensure that operational viability is not affected.

- A general noise management plan will be produced for the operation of the Site and will include good practice relating to such things as materials handling, no idling of engines, radios to be turned off etc. The requirement for this can be included in a suitably worded condition attached to the planning permission.

- Further to the above, if it is determined during the detailed design stage that there could be an adverse effect associated with general noise generating activities the Local Authority can ensure appropriate noise control measures by:

- Attaching planning conditions with regards to the above for the Proposed Development; and
- Attaching planning conditions to control delivery hours.

11.6.3 Calculations have been undertaken to predict the operational noise levels following the implementation of the above mitigation measures. The results are given in Tables 11.10 and 11.11 below. Details of the assumptions made and data used are contained within Appendix 11.2.

Table 11.10: Daytime operational noise levels at nearby sensitive receptors following mitigation

Location	Combined noise level with character correction (dB(A))	Background daytime noise level (L_{A90} dB(A))	Predicted difference
Wheldon Road	30.6	44.8	-14.2
Clarity	26.3	32.7	-6.4
Travellers	34.8	33.9	0.9

Table 11.11 – Night-time operational noise levels at nearby sensitive receptors following mitigation

Location	Combined noise level with character correction (dB(A))	Background daytime noise level (L_{A90} dB(A))	Predicted difference
Wheldon Road	21.7	39.5	-17.8
Clarity	19	31.5	-12.5
Travellers	25.4	32.6	-7.2

11.6.4 Tables 11.10 and 11.11 show the difference between the predicted noise levels from operational noise sources following mitigation and existing background noise levels at those sensitive receptors likely to experience effects from operational noise. During the daytime the specific noise level is the same as or below the prevailing background noise level which will suggest that the likelihood of complaints is of below marginal significance according to BS 4142. At 10 dB and more below background complaints are unlikely. With reference to Table 11.1 the daytime effect magnitude will be **negligible** with a **neutral** significance at all locations.

11.7 RESIDUAL EFFECTS

Table 11.12 provides an assessment summary of the potential environmental effects and the anticipated residual environmental effects, following the implementation of the proposed mitigation, compensation or enhancement measures.

Table 11.12: Residual Environmental Effects

Effects	Receptor Sensitivity	Effect Magnitude	Nature of Effect	Effect Duration	Significance	Mitigation	Residual Effect Magnitude	Residual Effects Significance	Rationale
Construction Phase									
Construction Noise	Low	Negligible to substantial	Negative, direct	Short-term, temporary	Minor – moderate to neutral	Restriction of working hours, use of good practice	Substantial to negligible	Minor - moderate to Neutral	Noise levels are high and difficult to effectively mitigate, however, construction works are short term and are restricted to typical working hours
Road Traffic Noise	Low	Negligible to substantial	Negative, direct	Short-term, temporary	Minor – moderate to neutral	Restriction of working hours, use of good practice	Substantial to negligible	Minor - moderate to Neutral	Noise levels are high and difficult to effectively mitigate, however, construction works are short term and are restricted to typical working hours
Vibration	Low	Negligible	N/A	N/A	Neutral	N/A	Negligible	Neutral	Piling, if necessary, is at a distance to receptors.
Operational Phase									
Operational Noise	Low	Substantial to Negligible	Negative direct	Long term, permanent	Moderate-minor to neutral	Use of enclosures and absorption within building, barriers, stack attenuators	Negligible	Neutral	Limited information is available specifying noise levels generated by the Proposed Development; a possible scenario has been attributed. Mitigation measures will be very effective in reducing effect.
Road Traffic Noise	Low	Negligible	N/A	N/A	Neutral	N/A	Negligible	Neutral	The increase in road traffic due to the Proposed Development will give only a negligible increase in noise levels.
Vibration	Low	Negligible	N/A	N/A	Neutral	N/A	Negligible	Neutral	It is considered that no vibration will be caused from the Proposed Development

11.8 SUMMARY

11.8.1 A noise and vibration assessment has been undertaken to determine the potential effect of the proposed scheme at identified receptors. Such receptors include residential properties located to the north, west and south of the Proposed Development.

11.8.2 With regard to effects during the construction phase, the worst case unmitigated noise effect magnitude for certain periods of the construction works is predicted to be substantial adverse at receptors which have a low sensitivity. The effect will be negative, direct, temporary and short-term. The unmitigated effect significance is considered to be moderate – minor adverse, in accordance with the stated assessment methodology. Construction works are temporary and through Best Practice the effects can be minimised.

11.8.3 The potential vibration effect during the construction phase is considered to be negligible in magnitude and neutral in significance.

11.8.4 With regard to operational effects, due to the nature of the proposed development and, where appropriate, through good design, the general effect of the proposed development will be moderate to negligible in magnitude and minor to neutral in significance. It should be noted that there is likely to be the requirement to employ mitigation measures to minimise noise associated with plant and waste deliveries with particular regard to the nearest residential dwellings. Mitigation measures are very effective in reducing noise and the residual effects following mitigation are expected to be negligible in magnitude and neutral in significance. The effect is predicted to be long term and permanent.

11.8.5 The potential operational vibration effect is considered to be negligible in magnitude and neutral in significance.