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15. Materials and Waste

15.1 Introduction

15.1.1 This chapter of the Environmental Statement (ES) reports the findings of an assessment of the likely significant effects on materials and waste as a result of the Proposed VPI Development and the Proposed Phillips 66 Development (collectively referred to as the 'Proposed Developments').

15.1.2 The potential for effect interactions on a single receptor ('in-combination effects') are discussed in Chapter 18: Cumulative and Combined Effects.

15.1.3 This chapter follows the methodology set out in the Institute of Environmental Management and Assessment (IEMA) guide to Materials and Waste in Environment Assessment, Guidance for a Proportionate Approach (referred from herein as the 'IEMA Guidance') (IEMA, 2020).

15.1.4 For the purpose of this ES, materials and waste comprise:

- the consumption of materials (key construction materials only); and
- the generation and management of waste.

15.1.5 Materials are defined in the IEMA Guidance materials as "*physical resources that are used across the lifecycle of a development. Examples include key construction materials such as concrete, aggregate, asphalt and steel*."

15.1.6 Other material assets considered include built assets such as landfill void capacity and allocated/safeguarded mineral and waste sites.

15.1.7 Impacts on Mineral Safeguarding Areas (MSAs) are not assessed in the materials and waste assessment in accordance with the IEMA Guidance but are mentioned in the baseline section to provide context.

15.1.8 Waste is defined as per the Waste Framework Directive (Waste FD) (European Union (EU), 2008) as "*any substance or object which the holder discards or intends or is required to discard*".

15.2 Legislation and Planning Policy Context

15.2.1 This assessment has been undertaken taking into account relevant legislation, planning policy and guidance as set out in national, regional and local planning policy (summarised in the sections below). The legislation and policy requirements have informed the preparation of this ES chapter.

National Legislation

15.2.2 The following national legislation is taken into account:

- Waste FD (EU, 2008);
- The Environmental Protection Act (1990) (Her Majesty's Stationary Office (HSMO), 1990);
- The Hazardous Waste (England and Wales) Regulations (2005) as amended (HMSO, 2005);
- The Waste (England and Wales) Regulations (2011) as amended (HMSO, 2011);
- The Environmental Permitting (England and Wales) Regulations (2016) (HMSO, 2016); and
- The Environment Act 2021 (HMSO, 2021).

15.2.3 The Waste (England and Wales) Regulations 2011 (as amended) (HMSO, 2011) transpose the requirements of the Waste FD (EU, 2008) in England and Wales and require the Secretary of State to establish waste prevention programmes and waste management plans that apply the waste hierarchy. The waste hierarchy is defined in the Waste FD and prioritises waste prevention, followed by preparing for reuse, recycling, recovery and finally disposal as means of management of waste.

15.2.4 The Waste (England and Wales) Regulations 2011 (as amended) (HMSO, 2011) require businesses to apply the waste hierarchy when managing waste, and also require that measures are taken to ensure that, by the year 2020 and beyond, at least 70% by weight of non-hazardous construction and demolition waste is subjected to material recovery. The target specifically excludes naturally occurring materials with European Waste Catalogue (EWC) Code 17 05 04 (17 05 04 soil and stones other than those mentioned in 17 05 03* (soils and stone containing dangerous substances)).

15.2.5 A departure from the waste hierarchy can be undertaken so as to achieve the best overall environmental outcome where this is justified by life-cycle thinking on the overall impacts of the generation and management of the waste. However the following considerations must also be taken into account:

- environmental protection principles of precaution and sustainability;
- proximity principle for treatment and disposal of waste to be as close to its source as possible;
- technical feasibility and economic viability;
- protection of resources; and
- overall environmental, human health, economic and social impacts.

National Policy

15.2.6 The Proposed Developments will be assessed with consideration to national policy that addresses the use of material and waste generation and its management.

15.2.7 The following national policies are also relevant to the Proposed Developments:

- National Planning Policy Framework (NPPF) (2021) (Ministry of Housing, Communities & Local Government, 2021);
- National Planning Policy Guidance for Minerals (2014) (MHCLG, 2014a):
- National Planning Policy Guidance for Waste (2015) (MHCLG, 2015);
- National Planning Policy for Waste (2014) (MHCLG, 2014b);
- The Waste Management Plan for England (2021) (Department for Environment, Food & Rural Affairs, 2021a);
- A Green Future: Our 25 Year Plan to Improve the Environment (2018) (DEFRA, 2018a): and,
- Our Waste, Our Resources, A Strategy for England (Resources and Waste Strategy for England) (2018) (DEFRA, 2018b).

15.2.8 Details of relevant national policy to the Proposed Development are presented in Table 15.1.

Table 15.1: National Planning Policy relevant to materials and waste

Policy Reference	Policy Context
NPPF (MHCLG, 2021)	The NPPF does not contain specific waste policies as these are detailed within the revised Waste Management Plan for England (2021) and the

Policy Reference	Policy Context
	National Planning Policy for Waste, however the following overarching policies are relevant to waste and resources: a. The environmental objective set out at paragraph 8 of the NPPF is "*to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*" b. The environmental objective set out in paragraph 210 of the NPPF is to "*so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously.*"
National Planning Policy Guidance (PPG) for Minerals (MHCLG, 2014a) and Waste (MHCLG, 2015)	Published to provide more in-depth guidance to the NPPF. The PPG aims to make planning guidance more accessible and ensures that the guidance is kept up to date.
National Planning Policy for Waste (MHCLG, 2014b)	The National Planning Policy for Waste sets out detailed waste planning policies to be applied in conjunction with the NPPF. It states: "*when determining planning applications for non-waste development, local planning authorities should, to the extent appropriate to their responsibilities, ensure that:* • *The likely impact of proposed, non-waste related development on existing waste management facilities, and on sites and areas allocated for waste management, is acceptable and does not prejudice the implementation of the waste hierarchy and/or the efficient operation of such facilities;* • *New, non-waste development makes sufficient provision for waste management and promotes good design to secure the integration of waste management facilities with the rest of the development, and;* • *The handling of waste arising from the construction and operation of development maximises reuse/recovery opportunities, and minimises off-site disposal".*
Waste Management Plan for England (DEFRA, 2021a)	Provides an overview of waste management in England and reiterates the requirement for all waste producers and waste management providers to implement the waste hierarchy. It also highlights the need for waste to be managed using the proximity principle and confirms England's commitment to recovering at least 70% by weight of non-hazardous construction and demolition waste by 2020 (excluding soils and stones). Recovery is assumed in the context of this policy to include reuse, recycling and incineration with energy recovery.
A Green Future: Our 25 Year Plan to Improve the Environment (DEFRA, 2018a)	Plan to Improve the Environment published in 2018, "*sets out goals for improving the environment within a generation and leaving it in a better state than we found it*". It details how the government will work with communities and businesses to do this. The following policies are relevant: • Make sure that resources are used more efficiently and kept in use for longer to minimise waste and reduce its environmental impacts by promoting reuse, remanufacturing and recycling.

Policy Reference	Policy Context
	• Work towards eliminating all avoidable waste by 2050 and all avoidable plastic waste by the end of 2042. • Reducing food supply chain emissions and waste. • Reducing litter and littering. • Improving management of residual waste.
Resources and Waste Strategy for England (DEFRA, 2018b)	The strategy published in 2018 will help the government to meet the commitments outlined in the 25 Year Plan and *"sets out how we will preserve our stock of material resources by minimising waste, promoting resource efficiency and moving towards a circular economy. At the same time we will minimise the damage caused to our natural environment by reducing and managing waste safely and carefully, and by tackling waste crime."* The strategy combines actions to be taken now and commitments for the coming years. Key targets and milestones and targets, which could be relevant to the Proposed Developments, include: • Roll out of a deposit return scheme (subject to consultation) – 2023; • Legislation for mandatory separate food waste collections (subject to consultation) – 2023; • 75% recycling rate for packaging (subject to consultation) – 2023; • 65% recycling rate for municipal solid waste – 2035; and • Municipal waste to landfill 10% or less – 2035.

Local Policy

15.2.9 The Proposed Developments will be assessed with consideration to local policy that address the use of material and waste generation and its management.

15.2.10 Details of relevant national policy to the Proposed Developments are presented in Table 15.2.

Table 15.2: Local Planning Policy relevant to materials and waste

Policy Reference	Policy Context
The North Lincolnshire Local Development Framework (adopted 2011) (North Lincolnshire Council (NLC), 2011)	This replaced the North Lincolnshire Local Plan which was adopted in 2003 and includes the Core Strategy which contains chapters regarding Sustainable waste management (Chapter 12) and Minerals (Chapter 13). Relevant policies include: • CS20 – Sustainable Waste Management • CS21 – Minerals North Lincolnshire is preparing a new single Local Plan for North Lincolnshire. Once agreed (formally adopted), it will replace the current North Lincolnshire Core Strategy and the Housing and Employment Land Allocations DPDs. The North Lincolnshire Local Plan Publication Draft (October 2021) (NLC, 2021) contains chapters regarding Planning for a Sustainable Supply of Minerals (Chapter 12) and Sustainable Waste Management (Chapter 13). Relevant policies include: • Policy MIN2 – Mineral Safeguarding • Policy MIN4 – Recycled and Secondary Aggregates

- Policy MIN6 – Mineral Sites
- Policy WAS1 – Waste Management Principles
- Policy WAS4 – Safeguarding Existing Waste Sites and Infrastructure
- Policy WAS6 – Waste Management in Development

The associated policy map shows the extent of waste sites and infrastructure, MSAs, and mineral sites and infrastructure. The Proposed Development Sites boundaries does not lie within any of these sites or areas.

Other Relevant Policy, Standards and Guidance

15.2.11 Additional guidance documents relevant to the materials and waste assessment which have been considered include:

- Contaminated Land: Applications in Real Environments (CL:AIRE) Definition of Waste: Development Industry Code of Practice (DoWCoP), v2 (2011) (CL:AIRE, 2011);
- Waste and Resources Action Programme (WRAP) Designing Out Waste: A Design Team Guide for Civil Engineering (WRAP, undated a); and,
- (WRAP Designing Out Waste: A Design Team Guide for Buildings (WRAP, undated b).

15.3 Assessment Methodology and Significance Criteria

15.3.1 This section outlines the methodology that will be employed for assessing the likely significant effects associated with materials and waste. The IEMA Guidance (IEMA, 2020) offers two methods for the assessment of waste. Method W1 – void capacity has been selected as this is a more detailed methodology and is appropriate for larger and more complex projects.

15.3.2 Some of the operational hazardous wastes likely to be generated by the Proposed Developments may not be suitable for landfill disposal e.g. liquid waste. Therefore, in addition to Method W1 – void capacity hazardous operational waste is compared to national hazardous waste management facility waste inputs.

Scope of Assessment

15.3.3 The assessment of materials and waste considers the following:

- waste producers have a legal duty of care to manage their waste in accordance with regulations and to ensure that any waste leaving the site where it is generated is transferred to a suitably licensed facility for further treatment or disposal;
- facilities transferring, treating or disposing of waste must be either licensed or apply for an exemption from a license, and impacts arising from the operation of waste management facilities are considered as part of the planning and permitting process for these facilities themselves;
- as part of their planning function, Waste Planning Authorities (WPAs) are required to ensure that sufficient land is available to accommodate facilities for the treatment of all waste arising in the area, either within the WPA area, or through export to suitable facilities in other areas; and
- MPAs are similarly required to ensure an adequate supply of minerals, sufficient to meet the needs of national and regional supply policies, and local development needs.

15.3.4 The following matters are not considered in the assessment of materials and waste:

- Waste arising from extraction, processing and manufacture of construction components and products. This is based on the assumption that these products and materials are being developed in a manufacturing environment with their own waste management plans, facilities, and supply chain, which are potentially in different regions of the UK or

the world and therefore outside of the geographical scope of this study. Such matters cannot be accurately predicted and assessed in the ES as they relate to procurement decisions that cannot be assured;

- Other environmental impacts associated with the management of waste from the Proposed Developments e.g., on water resources, air quality, noise or traffic resulting from the generation, handling, on-site temporary storage or off-site transport of materials and waste are addressed separately in other relevant chapters of this ES.
- Impacts on allocated mineral sites. There are no allocated mineral sites listed in the LDP within the Proposed Development Sites boundaries. This aspect is scoped out of the assessment; and
- Impacts on allocated waste sites. There are no allocated waste sites listed in the LDP within the Proposed Development Sites boundaries. This aspect is scoped out of the assessment.
- Direct impacts on MSAs. The Proposed Development Sites boundaries do not lie within any MSAs and impacts are not assessed in the materials and waste assessment in accordance with the IEMA Guidance. MSAs are included for context in the baseline since MSAs are a planning consideration.
- Effects on the availability of materials during operation: forecast effects are (using professional judgement) considered negligible in relation to the scale and nature of the Proposed Developments.
- Effects associated with decommissioning: As outlined in Chapter 3: Project Description, Needs and Alternatives Considered the Proposed Developments will have a design life of at least 25 years, yet the operational life could potentially be longer subject to market conditions which will be appraised as the projects operate. On this basis, decommissioning activities are currently anticipated to commence after 2056. At the end of their operating life, the most likely scenario is that the Proposed Developments would be shut down and all above ground structures removed from the Proposed Development Sites ('the Sites') (Proposed Developments' structures only). The Sites would then be suitably remediated as required to facilitate re-use. Decommissioning Plans (including Decommissioning Environmental Management Plans) would be produced for each of the Proposed Developments at the time of decommissioning and agreed with the Environment Agency as part of the Environmental Permitting and site surrender process. The Decommissioning Environmental Management Plans would consider in detail all potential environmental risks on the Sites and contain guidance on how risks can be removed or mitigated during the decommissioning and demolition.

15.3.5 Table 15.3 provides an outline scope of the assessment.

Table 15.3: Outline scope of the assessment

Project Phase	Effects	Scope In/ Out
Construction	Changes in demand for materials	Scope in
	Changes in available landfill void capacity	Scope in
	Changes to allocated mineral site	Scope out
	Changes to allocated waste site	Scope out
Operation	Changes in availability of materials	Scope out
	Changes in available landfill void capacity	Scope in
	Changes in available hazardous waste management facility capacity	Scoped in
Decommissioning	Changes in demand for materials	Scope out
	Changes in available landfill capacity	Scope out

Study Areas

15.3.6 The study areas for the assessment of impacts related to materials and waste have been defined in line with the IEMA Guidance. Two study areas are defined: a Proposed Developments study area (within which waste associated with the Proposed Developments is generated); and an expansive study area (within which waste facilities that manage waste generated by the Proposed Developments are likely to be located. Given the proximity of the two Sites, the same study area is considered to be relevant for both of the Proposed Developments.

15.3.7 Within this section, study areas are defined for the following:

- construction and operational waste generation;
- use of construction and operation materials (key construction materials only);
- non-hazardous, inert and hazardous construction waste management;
- non-hazardous, inert and hazardous operational waste management;
- availability of key construction materials;
- impacts on allocated/ safeguarded mineral and waste sites; and,
- presence of MSAs.

Proposed Developments Study Area

15.3.8 The Proposed Developments study area for construction and operational waste generation and use of construction and operation materials (key construction materials only) comprises the Proposed Development Sites boundaries. The study area is deemed to include the footprint of the proposed works, together with any temporary land requirements during the construction. This may include temporary offices, compounds and storage areas.

15.3.9 The Proposed Developments study area for the impacts on allocated/ safeguard mineral and waste sites is defined by the Proposed Development Sites boundaries. Impacts on allocated/ safeguarded waste sites are not included in the IEMA Guidance, however, are included for completeness.

15.3.10 Impacts on MSAs are not assessed in the materials and waste assessment in accordance with the IEMA Guidance. MSAs are included for context in the baseline since MSAs are a planning consideration.

Expansive Study Area

15.3.11 The expansive study area for non-hazardous waste management comprises the East Midlands and Yorkshire and the Humber. The study area includes the following sub-regions as outlined in the Environment Agency's (EA) 2021 Waste Summary Tables for England - Version 1 (EA, 2022a):

- Lincolnshire, Derbyshire, Leicestershire, Northamptonshire and Nottinghamshire;
- Former Humberside, North Yorkshire, South Yorkshire, West Yorkshire.

15.3.12 The expansive study area for non-hazardous and inert waste management is defined based on professional judgement and informed by consideration of the proximity principle and value for money. The study area has been determined to comprise the wider region within which landfill capacity is located i.e. East Midlands region and the Yorkshire and the Humber region since the project is located close to the northern border of the East Midlands and waste could be managed in either region.

15.3.13 The expansive study area for hazardous waste management is England. The study area is again defined based on professional judgement and informed by consideration of the proximity principle and value for money. The proximity principle for hazardous waste in England is outlined in Principle 2 - Infrastructure Provision in the Strategy for Hazardous Waste Management in England *"We look to the market for the development of hazardous waste infrastructure, which implements the hierarchy for the management of hazardous waste*

and meets the needs of the UK to ensure that the country as a whole is self sufficient in hazardous waste disposal, facilities are put in place for hazardous waste recovery in England, and the proximity principle is met" (DEFRA, 2010). Planning for hazardous waste management is also undertaken at a national level.

15.3.14 The expansive study area for availability of key construction materials (aggregates, asphalt, concrete and steel) is national (United Kingdom (UK) or Great Britain (GB) dependent on baseline information availability). Regional and local information on availability of key construction materials is included in the baseline for context but is not used in the materials and waste assessment.

Methodology for Determining Baseline Conditions and Sensitive Receptors

15.3.15 The sensitive receptors for the assessment of construction impacts are:

- landfill void capacity in the expansive study areas of the East Midlands and Yorkshire and the Humber (non-hazardous and inert landfill void capacity), and England (hazardous landfill void capacity) – as defined in the IEMA guidance "*landfill is a finite resource, and hence – through the ongoing disposal of waste – there is a continued need to expand existing and develop new facilities, This requires the depletion of natural and other resources which, in turn, adversely impacts the environment.*"; and
- materials, national consumption of key construction materials – as outlined in the IEMA guidance "materials are, in their own right, sensitive receptors. Consuming materials impacts upon their immediate and (in the case of primary material) long-term availability; this results in the depletion of natural resources and adversely impacts the environment."

15.3.16 Impacts on MSAs are not assessed in the materials and waste assessment in accordance with the IEMA Guidance. MSAs are included for context in the baseline since MSAs are a planning consideration and further consultation and assessment in accordance with Mineral Planning Authority policies may be required at a later stage.

15.3.17 The sensitive receptors for the assessment of operational impacts are:

- landfill void capacity in the expansive study areas of the East Midlands and Yorkshire and the Humber (non-hazardous and inert landfill void capacity), and England (hazardous landfill void capacity).

15.3.18 The IEMA guidance *"does not consider waste processing and recovery facilities as sensitive receptors, rather: they are part of a system that has the potential to reduce the magnitude of adverse impacts associated with waste generation and disposal. Waste processing and recovery facilities are, hence, different to landfills, in that the latter are finite resources."* However, since some of the operational hazardous wastes likely to be generated by the Proposed Developments may not be suitable for landfill disposal e.g. liquid waste, hazardous operational waste is compared to national hazardous waste management facility capacity in this assessment.

15.3.19 A baseline has been developed in accordance with the IEMA guidance and consists of:

- national availability (UK or GB) (consumption/sales) for key construction materials (steel, aggregates, asphalt and concrete);
- MSAs and allocated/safeguarded mineral sites;
- allocated/ safeguarded waste sites;
- landfill void capacity in the East Midlands and Yorkshire and the Humber (non-hazardous and inert landfill void capacity), and England (hazardous landfill void capacity); and
- waste received at relevant hazardous waste management facilities nationally.

Methodology for Determining Construction Effects

15.3.20 The sensitivity of receptors and magnitude of impacts materials and waste for construction will be assessed through the following:

Materials

- establishing the baseline for national consumption of key construction materials by weight;
- assessing the sensitivity of materials as related to the availability and types of materials to be consumed by the Proposed Developments in construction;
- establishing the quantities of key construction materials required for the construction of the Proposed Developments; and
- comparing the total quantities of key construction materials with the most recent national demand (utilising a percentage approach).

Waste

- establishing the baseline landfill void capacity in the expansive study areas;
- assessing the sensitivity of landfill void capacity;
- establishing the quantities of construction, demolition and excavation waste to be generated during the construction of the Proposed Developments; and
- comparing the total waste arising from the construction of the Proposed Developments against the landfill void capacity (utilising a percentage approach).

Methodology for Determining Operational Effects

15.3.21 The sensitivity of receptors and magnitude of impacts for waste for operation will be assessed through the following:

- establishing the baseline landfill void capacity in the expansive study areas;
- assessing the sensitivity of landfill void capacity;
- establishing the quantities of operational waste to be generated during the operation of the Proposed Developments;
- comparing the total waste arising from the operation of the Proposed Developments against the landfill void capacity (utilising a percentage approach); and
- comparing operational hazardous waste arisings from the operation of the Proposed Developments against national hazardous waste management facility waste inputs (utilising a percentage approach).

Significance Criteria

Sensitivity

15.3.22 The sensitivity of materials relates to the availability and type of construction material to be consumed by the Proposed Developments. The IEMA guidance criteria described within Table 15.4 is used to determine the sensitivity of materials.

Table 15.4: Materials receptor sensitivity

Effects	Criteria for Materials Receptor Sensitivity
Negligible	On balance, the key materials required for the construction of the Proposed Developments are forecast (through trend analysis and other information) to be free from known issues regarding supply and stock. *And/or*

Effects	Criteria for Materials Receptor Sensitivity
	are available comprising a very high proportion of sustainable features and benefits compared to industry-standard materials.*
Low	On balance, the key materials required for the construction of the Proposed Developments are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock. *And/or* are available comprising a high proportion of sustainable features and benefits compared to industry-standard materials.
Medium	On balance, the key materials required for the construction of the Proposed Developments are forecast (through trend analysis and other information) to suffer from some potential issues regarding supply and stock. *And/or* are available comprising some sustainable features and benefits compared to industry-standard materials.
High	On balance, the key materials required for the construction of the Proposed Developments are forecast (through trend analysis and other information) to suffer from known issues regarding supply and stock. *And/or* Comprise little or no sustainable features and benefits compared to industry-standard materials.
Very High	On balance, the key materials required for the construction of the Proposed Developments are forecast are known to be insufficient in terms of production, supply and/or stock. *And/or* Comprise no sustainable features and benefits compared to industry-standard materials.

** Subject to supporting evidence, sustainable features and benefits could include, for example, materials or products that: comprise reused, secondary or recycled content (including excavated and other arisings); support the drive to a circular economy; or in some other way reduce lifetime environmental impacts.*

15.3.23 The sensitivity of waste relates to availability of landfill capacity in the absence of the Proposed Developments as outlined in the IEMA Guidance *"landfill capacity is recognised as an unsustainable and increasingly scarce option for managing waste"*. The sensitivity of landfill capacity is assessed based on a review of historic landfill void capacity trends where available, and information from relevant policy documents.

15.3.24 The criteria described within Table 15.5 and Table 15.6 will be used to determine the sensitivity of landfill capacity.

Table 15.5: Inert and non-hazardous landfill capacity sensitivity

Effects	Criteria for Inert and Non-hazardous Landfill Capacity Sensitivity
Negligible	Across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional inert and non-hazardous landfill capacity expected to remain unchanged or is expected to increase through a committed change in capacity.
Low	Across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional inert and non-hazardous landfill capacity is expected reduce minimally by <1% as a result of wastes forecast.

Effects	Criteria for Inert and Non-hazardous Landfill Capacity Sensitivity
Medium	Across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional inert and non-hazardous landfill capacity is expected reduce noticeably by 1-5% as a result of wastes forecast.
High	Across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional inert and non-hazardous landfill capacity is expected reduce considerably by 6-10% as a result of wastes forecast.
Very High	Across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional inert and non-hazardous landfill capacity is: • expected to reduce very considerably (by >10%); • end during construction or operation; • is already known to be unavailable; or, • would require new capacity or infrastructure to be put in place to meet forecast demand.

Table 15.6: Hazardous landfill capacity sensitivity

Effects	Criteria for Hazardous Landfill Capacity Sensitivity
Negligible	Across the construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional (or where justified, national) hazardous landfill capacity is expected to remain unchanged, or is expected to increase through a committed change in capacity.
Low	Across the construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional (or where justified, national) hazardous landfill capacity is expected to reduce minimally by <0.1% as a result of wastes forecast.
Medium	Across the construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional (or where justified, national) hazardous landfill capacity is expected to reduce noticeably by 0.1-0.5% as a result of wastes forecast.
High	Across the construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional (or where justified, national) hazardous landfill capacity is expected to reduce considerably by 0.5-1% as a result of wastes forecast.
Very High	Across the construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Developments) of regional (or where justified, national) hazardous landfill capacity is: • expected to reduce very considerably (by >1%); • end during construction or operation: • is already known to be unavailable; or, • would require new capacity or infrastructure to be put in place to meet forecast demand.

Magnitude

15.3.25 The magnitude of impact describes the degree of variation from the baseline conditions as result of the Proposed Developments. The methodology for assessing the magnitude of impact from materials comprises a percentage-based approach that determines the influence of construction materials use on the baseline national demand from the construction of the Proposed Developments. The criteria used to assess the magnitude of impact for materials are provided within Table 15.7.

Table 15.7: Materials magnitude of impacts

Effects	Criteria for Materials Magnitude of Impacts
No change	Consumption of no materials is required.
Negligible	Consumption of no individual material type is equal to or greater than 1% by volume of the national* baseline availability.
Minor	Consumption of one or more materials is between 1-5% by volume of the national* baseline availability; and The development has the potential to adversely and substantially** impact access to one or more allocated mineral site (in their entirety), placing their future use at risk.
Moderate	Consumption of one or more materials is between 6-10% by volume of the national* baseline availability; and One allocated mineral site is substantially** sterilised by the development rendering it inaccessible for future use.
Major	Consumption of one or more materials is >10% by volume of the national* baseline availability; and More than one allocated mineral site is substantially** sterilised by the development rendering it inaccessible for future use.

**a national baseline is used in the absence of regional construction material consumption data.*

***justified using professional judgement, based on the scale and nature of the allocated mineral site being assessed.*

15.3.26 The methodology for assessing the magnitude of impact for waste comprises a percentage-based approach that determines the influence of waste generation from the construction of the Proposed Developments on the baseline landfill capacity. The criteria used to assess the magnitude of impact for resources and waste are provided within Table 15.8 and Table 15.9.

Table 15.8: Inert and non-hazardous waste - magnitude of impact

Effects	Criteria for Waste Magnitude of Impacts
No change	Zero waste generation and disposal from the development.
Negligible	Waste generated by the development will reduce expansive study area landfill capacity baseline# by <1%
Minor	Waste generated by the development will reduce expansive study area landfill capacity baseline# by 1-5%
Moderate	Waste generated by the development will reduce expansive study area landfill capacity baseline# by 6-10%.
Major	Waste generated by the development will reduce expansive study area landfill capacity baseline# by >10%

 # forecast as the worst-case scenario, during a defined construction and/or operational phase.

Table 15.9: Hazardous waste - magnitude of impact

Effects	Criteria for Waste Magnitude of Impacts
No change	Zero waste generation and disposal from the development.
Negligible	Waste generated by the development will reduce expansive study area landfill capacity baseline# by <0.1%

Minor	Waste generated by the development will reduce expansive study area landfill capacity baseline[#] by <0.1-0.5%
Moderate	Waste generated by the development will reduce expansive study area landfill capacity baseline[#] by <0.5-1%
Major	Waste generated by the development will reduce expansive study area landfill capacity baseline[#] by >1%

 # forecast as the worst-case scenario, during a defined construction and/or operational phase.

Significance

15.3.27 Table 15.10 describes the effect thresholds used in determining the significance of potential effects and Table 15.11 shows the significance of the effects. Significance terminology is topic specific and varies slightly from the standard terminology set out in Chapter 1: Introduction and EIA Methodology (ES Volume I). In general:

- 'slight' broadly equates to 'minor'; and
- 'large' and 'very large' equate to 'major'.

Table 15.10: Effect thresholds

		Magnitude of Impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity of Receptor	**Very High**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table 15.11: Significance of effect

Effect	Materials	Waste
Neutral	Not significant	Not significant
Slight		
Moderate	Significant	Significant
Large		
Very large		

Sources of Information/ Data

15.3.28 The following sources of information have been reviewed and have informed the potential for likely significant effects:

- The North Lincolnshire Local Development Framework (adopted 2011) (NLC, 2011);

- North East Lincolnshire Local Plan 2013 to 2032 (adopted 2018) (NELC, 2018a);
- The EA's 2021 Waste Summary Tables for England - Version 1;
- The EA's 2020 Waste Data Interrogator (EA, 2022b);
- The EA's Permitted Waste Sites - Authorised Landfill Site Boundaries (EA, 2021a);
- The EA's Historic Landfill Sites (EA, 2021b);
- The EA's Environmental Permitting Regulations - Waste Sites (EA, 2022c);
- The EA's 2021 Remaining Landfill Capacity (EA, 2022d);
- Make UK's A New Deal for Steel: Laying the Foundations for a Vibrant UK steel industry, 2018 data (Make UK, 2019);
- (MPA's Minerals and mineral products sales in Great Britain, 2018 data (MPA, 2020);
- Local, regional and national policy (Section 15.2); and
- Legislation (Section 15.2).

Limitations

15.3.29 Construction waste from each of the Proposed Developments has been estimated based on the capital costs of construction, as detailed information is not available at this stage of the Proposed Developments.

15.3.30 Worst case assumptions have been made to inform this assessment, in particular it is assumed that all operational waste from the PCC plants is hazardous. This ensures that a robust, worst case assessment of the waste impacts of the Proposed Developments is provided.

Consultation

15.3.31 The EIA Scoping Report was submitted in January 2022 and the Scoping Opinion was received from NLC on 11th March 2022. No comments on the approach set out in the scoping report were raised in relation to the materials and waste assessment.

15.4 Baseline Conditions

Regional and National Availability of Key Construction Materials

15.4.1 UK and GB data has been used to establish a quantitative national baseline of the consumption for key constructional materials. Table 15.12 summarises national consumption in 2018 for aggregates, asphalt, concrete and steel (the most recent years for which data is available), which are the key construction materials expected to be used during the construction of the Proposed Developments. Regional data is presented in Table 15.13 to provide regional context, however, this data is not used within the assessment. Construction material sales by region are provided for the regions surrounding the Proposed Developments. It is assumed that the majority of key construction materials would be sourced locally, taking into account the proximity principle and value for money.

Table 15.12: National consumption and demand for key construction materials

Material	National Consumption (Million Tonnes, Year)	Baseline Data Year	Data Description	1% of National Consumption (Tonnes)	5% of National Consumption (Tonnes)
Steel	17	2018	UK total consumption	170,000	850,000

Material	National Consumption (Million Tonnes, Year)	Baseline Data Year	Data Description	1% of National Consumption (Tonnes)	5% of National Consumption (Tonnes)
			(Make UK, 2019)		
Aggregates of which:	251	2018	Minerals and mineral products sales in Great Britain (MPA, 2020)	2,510,000	12,550,000
Crushed rock	117.3			1,173,000	5,865,000
Sand and gravel - land won	48.9			489,000	2,445,000
Sand and gravel - marine	13.7			137,000	685,000
Recycled and secondary	71			710,000	3,550,000
Asphalt	25.4			254,000	1,270,000
Concrete of which:	86.2			862,000	4,310,000
Ready-mixed concrete	54.2			542,000	2,710,000
Concrete products	32			320,000	1,600,000

Table 15.13: Construction material sales by region (MPA, 2020)

Construction material	East Midlands	Yorkshire and the Humber
Crushed rock (million tonnes)	26.5	11.5
Sand and gravel (million tonnes)	6.1	2.3
Ready-mixed concrete (million m^3)	1.4	1.2
Asphalt (million tonnes)	2.8	2.1

15.4.2 Potential recycled contents for the main construction materials are outlined in Table 15.14. These "*good practice*" rates are derived from WRAP's Designing Out Waste Tool for Civil Engineering (WRAP, undated c).

Table 15.14: Potential recycled content

Material type	Potential recycled content (% by weight)
Concrete	16
Asphalt	25
Aggregates	50
Steel reinforcement	100

Structural steel	60

15.4.3 There is no publicly available information on any potential long-term changes to this national demand by the time of construction of the Proposed Developments. Construction material demand such as ready mixed concrete is closely aligned to both the quantity of construction taking place and the general economy, therefore, it is deemed inappropriate to forecast future demand as the demand is unlikely to be linear. It is therefore not possible to set a future baseline for resources. Therefore, future consumption is assumed to same as the current baseline as outlined in Table 15.12.

Mineral Safeguarding Areas, Allocated/ Safeguarded Mineral and Waste Sites

15.4.4 The Proposed Development Sites do not lie within any MSAs, allocated or safeguarded mineral sites or any allocated or safeguarded waste sites as identified in the North Lincolnshire Local Development Framework (adopted 2011) (NLC, 2011).

Landfill Capacity

15.4.5 Remaining landfill capacity at the end of 2020 as outlined on the EA's 2021 Waste Summary Tables for England – Version 1 (EA, 2022a) for the non-hazardous and inert waste expansive study area (East Midlands and Yorkshire and the Humber) and the hazardous waste study area (England) are shown in Table 15.15.

15.4.6 Merchant landfills are operated for commercial purposes accepting waste from construction projects and operating businesses. Merchant landfills are therefore considered to form the baseline. In contrast, restricted landfills are sites that deal with their own produced waste (i.e. not operating for commercial purposes) and therefore additional capacity is excluded from the baseline. Some non-hazardous landfills have a Stable Non-Reactive Hazardous Waste Cell (SNHRW) e.g. for asbestos. SNHRW cells usually form only a small fraction of the overall capacity, therefore, for assessment purposes non-hazardous landfills with SNRHW cells are considered in the same way as non-hazardous landfills.

Table 15.15: Landfill capacity (2021) in East Midlands, Yorkshire and The Humber, and England

Landfill type	Sub-Region			
	East Midlands	Yorkshire and the Humber	Total in East Midlands and Yorkshire and the Humber	England
	Capacity ('000s m3)			
Hazardous merchant	800	700	1,500	12,107
Non-hazardous with SNRHW cell	15,884	1,243	17,127	52,006
Non-hazardous	17,570	45,196	62,766	162,369
Inert	21,574	25,283	46,857	129,078

15.4.7 The EA published landfill capacity trends for 2004 to 2021 in 2022 within the EA's 2021 Waste Summary Tables for England – Version 1 (EA, 2022a). Plate 15.1 presents the historic trend for remaining landfill capacity for the East Midlands and Yorkshire and the Humber. Plate 15.2 presents the historic trend for remaining landfill capacity for England. Data is only available

for "*Inert*" (inert landfill only) and "*Non-Inert*" (non-hazardous landfill sites, non-hazardous landfill sites with a SNHRW cell and merchant hazardous landfill sites) therefore the categories do not align with the 2021 landfill capacity data which is split by hazardous, non-hazardous and inert.

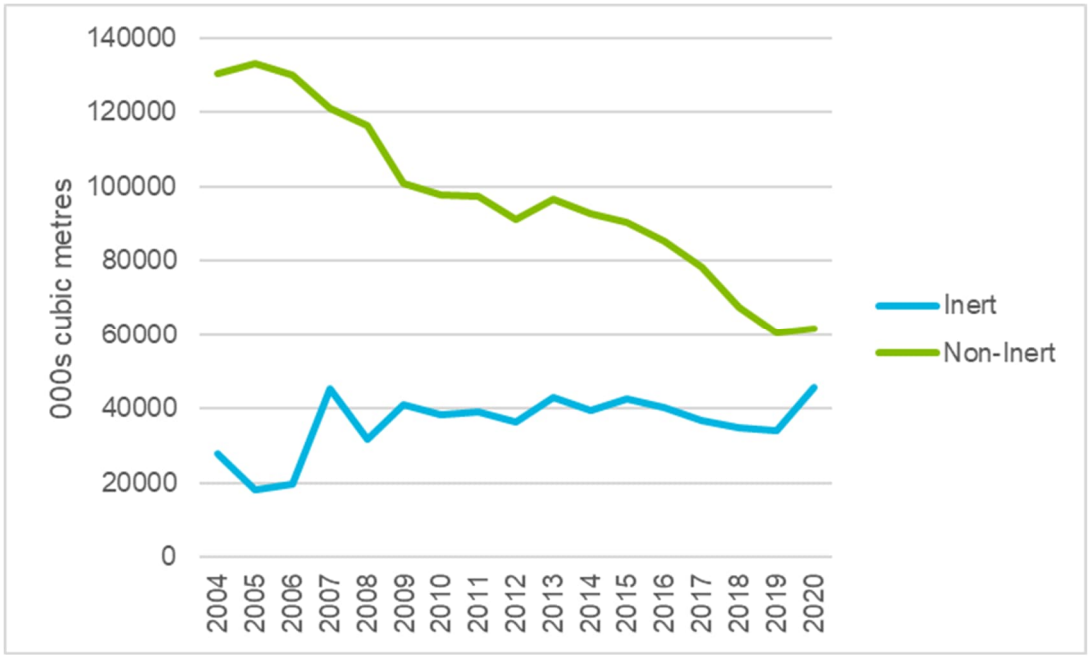

Plate 15.1: Historic trend for landfill void capacity in East Midlands and Yorkshire and the Humber

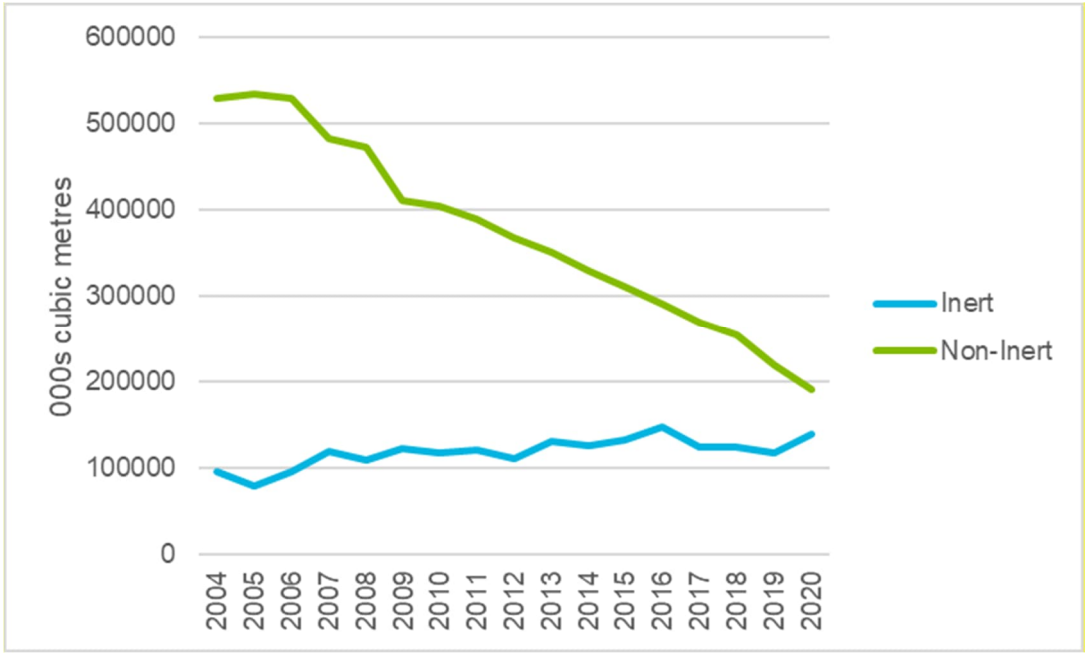

Plate 15.2: Historic trend for landfill void capacity in England

15.4.8 There is no publicly available information on any potential changes to this landfill capacity by the time of the construction of the Proposed Developments. Due the cyclic nature of inert landfill capacity, it is not realistic to forecast future landfill capacity since this may result in an increase in landfill capacity. Therefore, inert landfill capacity is assumed to remain the same as the current baseline outlined in Table 15.15. For non-inert landfill capacity (which includes hazardous waste) using the current rate of decline of landfill capacity and forecasting into the future would lead to the inevitable conclusion that there would be no void space remaining. However, this is not a credible scenario: if there is still a need for landfill, then the waste planning authority will need to consent new landfill capacity to replace that which has been

used up. Therefore, non-hazardous and hazardous landfill capacity is assumed to remain the same as the current baseline outlined in Table 15.15.

Waste Management Infrastructure

15.4.9 Capacity of other types of waste infrastructure is publicly available (e.g. Environmental Permitting Regulations - Waste Sites (EA, 2022c), however the permitted capacity is not necessarily representative of the actual operational capacity of the infrastructure. Therefore, inputs data are collated from the EA's Waste Data Interrogator for 2021 – Waste Received (Excel) – Version 1 (EA, 2022b) and presented in Table 15.16 for the East Midlands and Yorkshire and the Humber regions. Inputs are not totalled since the double counting of waste in the Waste Data Interrogator cannot be discounted.

Table 15.16: Summary of waste inputs by facility (2021)

Facility Type	East Midlands (Tonnes Received)	Yorkshire and the Humber (Tonnes Received)
Landfill	4,238,163	4,501,192
Metal Recycling Site (MRS)	843,958	1,817,180
On/ In Land	551,542	1,397,745
Transfer	4,588,886	5,394,163
Treatment	7,389,323	14,703,527
Combustion	72,986	71,810
Incineration	1,006,895	2,908,832
Mobile Plant	4,575	752
Mining	146,905	315,692
Storage	185,618	534,065
Processing	4,238,163	4,501,192

National Hazardous Waste Management Facilities

15.4.10 Since some of the operational hazardous wastes likely to be generated by the Proposed Developments will not be suitable for landfill disposal e.g. liquid waste, hazardous operational waste is compared to national hazardous waste management facility capacity in this assessment.

15.4.11 Liquid hazardous waste from the operation of the Proposed Developments may be managed by high-temperature incineration or by physical-chemical treatment. Sludge may be managed by these methods, or in a worst case landfilled. Alternatively, in the longer term, some form of waste treatment may be developed on or near to the Proposed Developments to manage waste generated in the post-combustion carbon capture (PCC) plants and other carbon capture facilities in the area, should other developments seek to undertake carbon capture, as planned for the Humber Industrial Cluster. However, in the absence of such facilities, this assessment conservatively does not consider the potential for such waste treatment facilities to be developed.

15.4.12 As carbon capture and storage (CCS) technology has yet to be implemented at scale in the UK, there are no facilities that currently accept waste streams from CCS as there are no arisings in the UK. Consequently, the specific management route for PCC plant wastes will be determined in consultation with potential waste vendors following appointment of a contractor.

15.4.13 Due to the specialised nature of hazardous waste management, hazardous waste facilities typically receive wastes from a wide region, and therefore this assessment considers the national capacity for managing hazardous wastes.

15.4.14 The EA's 2021 Waste Summary Tables for England – Version 1 (EA, 2022a) reported that the remaining merchant (non-restricted) hazardous landfill capacity in England was 12.1 million m^3.

15.4.15 Table 15.17 below shows the landfill sites accepting merchant (non-restricted) hazardous waste in England, and their remaining capacity (EA, 2022d). The two sites listed at the top of the table are within the East Midlands and Yorkshire and The Humber. Hazardous waste landfill sites that report zero remaining capacity are excluded.

Table 15.17: Merchant hazardous landfill sites in England and their remaining capacity (2021)

Facility Name	Operator Name	EA Area	Remaining Capacity End 2021 (m^3)
East Northants Resource Management Facility	Augean South Limited	Lincolnshire and Northamptonshire	800,000
Winterton South Landfill	Integrated Waste Management Ltd	Lincolnshire and Northamptonshire	700,00
BAE Systems Landfill	BAE Systems Properties Ltd	Cumbria and Lancashire	1,100,000
Port Clarence landfill Site (Haz)	Augean North Limited	Northumberland Durham and Tees	2,477,350
ICI NO 3 Teesport	Highfield Environmental Limited	Northumberland Durham and Tees	2,009,009
Whitemoss Landfill	Whitemoss Landfill Holdings Ltd	Cumbria and Lancashire	225,841
Bostock Landfill	Veolia ES (UK) Limited	Greater Manchester, Mersey and Cheshire	1,401,605
Randle Landfill Site	INEOS ChlorVinyls Limited	Greater Manchester, Mersey and Cheshire	2,015,898
Eardswick Hall Landfill Site	Brock PLC	Greater Manchester, Mersey and Cheshire	16,745
Pinden Quarry	Pinden Limited	Kent and South London	121,318
Wingmoor Farm	S Grundon (Waste) Ltd	Shropshire, Herefordshire, Worcestershire and Gloucestershire	991,399
Parkgate Farm Hazardous waste landfill	Hills Waste Solution Limited	West Thames	247,353

15.4.16 There are a number of high-temperature hazardous waste incinerators in England (excluding facilities which manage only clinical waste and received less than 500 tonnes), as well as

cement kilns which are permitted to accept hazardous waste. These facilities as reported in the EA's Waste Data Interrogator for 2021 (EA, 2022b), and are shown in Table 15.18.

Table 15.18: Hazardous waste incineration facilities

Facility	Location	2021 Waste Received (Tonnes of Hazardous Waste)
Hazardous Waste Incinerators		
Avonmouth Treatment Centre	Bristol	6,318
East Kent Waste Recovery Facility	Kent	4,615
Ellesmere Port Incinerator	Cheshire	56,488
Fawley HT Incinerator	Hampshire	30,287
Kirk Sandall Thermal Treatment Plant	Doncaster	5,304
Fine Environmental Services – Seal Sands	Tees Valley	19,018
Twinwoods Co-incinerator	Bedford	3,583
Cement Kilns accepting Hazardous Waste		
Cauldon Cement Plant	Staffordshire	117,323
Ketton Works	Rutland	26,195
Tunstead Cement and Lime Works	Derbyshire	14,881
Rugby Cement Plant	Rugby	19,480
Ribblesdale Cement Works	Ribble Valley	23,968
Whitwell Quarry Lime Works	Derbyshire	31,730
Total		**359,190**

15.4.17 The EA's Waste Data Interrogator for 2021 (EA, 2022b) shows the following quantities of liquid hazardous waste were treated by permitted facilities in England (excluding waste in EWC Code Chapter 13 "*Oil Wastes and Wastes of Liquid Fuels*"). Inputs are totalled, however, double counting of waste in the Waste Data Interrogator cannot be discounted.

Table 15.19: Hazardous liquid waste treatment facilities in England

Facility Permit Type	2021 Waste Received (Tonnes)
T05: Physico-chemical treatment installation	290,279
T06: Chemical treatment installation	143,314
T10: Haz waste treatment installation	178,591
T11: Haz waste transfer/treatment installation	32,651
Total	**644,835**

15.4.18 Within East Midlands and Yorkshire and the Humber, the following facilities have been identified (excluding smaller facilities receiving less than 1,000 tonnes of waste) using the same criteria as above. Inputs are totalled, however, double counting of waste in the Waste Data Interrogator cannot be discounted.

Table 15.20: Hazardous liquid waste treatment facilities in East Midlands and Yorkshire and the Humber

Facility	2021 Waste Received (Tonnes)	Location
T05: Physico-chemical treatment installation		
Air Street Site - EPR/HP3398EQ	5,662	Hull
Ann Watson Street Site - EPR/FP3630MZ	7,388	Hull
Bilsthorpe Oil Treatment Plant - EPR/DP3331MG	1,231	Newark and Sherwood
Carr Crofts Waste Treatment Facility EPR/YP3832WS	7,201	Leeds
Ilkeston Waste Treatment and Transfer Facility EPR/AP3337SJ	17,457	Erewash
New Duston Oil & Solvent Reclamation Works - EPR/XP3237MZ	10,804	Northampton
T06: Chemical treatment installation		
Ecclesfield Industrial Waste Treatment Facility EPR/MP3631SM	5,594	Sheffield
Knostrop Waste Treatment Facility EPR/MP3231SD	46,198	Leeds
T10: Haz waste treatment installation		
No facilities received greater than 1000 tonnes of hazardous liquid waste		
T11: Haz waste transfer/treatment installation		
Norwood Recycling Centre EPR/CB3805KE	26,433	Derbyshire

Historic and Permitted Landfills

15.4.19 The Proposed Development Sites do not lie within any "*Authorised Landfill Permitted Waste Sites*" as outlined in the EA's Permitted Waste Sites - Authorised Landfill Site Boundaries spatial data (EA, 2021a).

15.4.20 Historic landfills are potentially relevant to this assessment since excavations in historic landfill can give rise to waste that would require management.

15.4.21 The EA's Historic Landfill Sites spatial data (EA, 2021b) identifies one historic landfill site to the south of the boundary of the Philips 66 Site, and another close to the boundary of the Phillips 66 Site to the north-east across Eastfield Road. There is an on-site historic landfill, the site name is "*South Killingholme Conoco*", and the site is approximately less than 50 m wide. The historic landfill adjacent to the Phillips 66 Site is much larger, known as the "*Eastfield Road Landfill Site*". This site was operated by Humberside County Council and waste (including inert, industrial, commercial, household, special and liquid sludge) was inputted between 1975 and 1988.

15.4.22 Another historic landfill is located to the North of the VPI Site known as the *"Lindsey Oil Refinery"*. This site waste operated by Lindsey Oils and waste (including liquid and sludge) inputted from 1986.

15.4.23 Further information regarding historic landfill is presented in Chapter 13: Geology, Hydrogeology and Land Contamination (ES Volume I).

Targets

15.4.24 The national target for recovery of construction and demolition waste is 70% by weight, as set out in the Waste FD (EU, 2008) and the Waste Management Plan for England (DEFRA, 2021a). The target specifically excludes naturally occurring materials with EWC Code 17 05 04 (17 05 04 soil and stones other than those mentioned in 17 05 03* (soils and stone containing dangerous substances)). Recovery is deemed to include reuse, recycling and other recovery e.g. energy recovery.

15.4.25 A good practice landfill diversion target of 90% has been achieved and exceeded by major UK developments as outlined in the IEMA Guidance. In 2018, the UK generated 67.8 million tonnes of non-hazardous C&D waste, of which 62.6 million tonnes was recovered. This represents a recovery rate of 92.3% (DEFRA, 2021b).

15.4.26 Standard, good and best practice recovery rates by material are provided by WRAP (WRAP, 2007). Recovery rates for key construction materials and other construction wastes relevant to the Project are provided in Table 15.21.

Table 15.21: Standard, good and best practice recovery rates by material

Material	Standard Practice Recovery (%)	Good Practice Recovery (%)	Best Practice Recovery (%)
Metals	95	100	100
Packaging	60	85	95
Concrete	75	95	100
Inert	75	95	100
Plastics	60	80	95
Miscellaneous	12	50	75
Electrical equipment	Limited information	70	95
Cement	Limited information	75	95
Liquids and oils	100	100	100
Hazardous	50	Limited information, cannot be 100% since some hazardous waste e.g. asbestos must be landfilled.	

Receptor Sensitivity

Material Receptor Sensitivity

15.4.27 Material receptor sensitivity is determined as ‘low’. On balance, the key materials required for the construction and operation of the Proposed Developments are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock. Key materials required for the construction and operation are likely to be available comprising a high proportion of sustainable features and benefits (e.g. recycled content).

15.4.28 Potential recycled content for the main construction materials are outlined in Table 15.14.

Waste Receptor Sensitivity

15.4.29 Waste receptor sensitivity is determined as ‘very high’. Since there is no publicly available information on any potential changes to landfill capacity by the time of the construction or operation of the Proposed Developments a worst scenario is considered:

- that (without the Proposed Developments) non-hazardous landfill void capacity in the expansive Study Area is expected to:
  - reduce very considerably (by >10%);

- end during construction and operation;
- is already known to be unavailable; or,
- would require new capacity or infrastructure to be put in place to meet forecast demand.

- that (without the Proposed Developments) hazardous landfill void capacity in the expansive Study Area is expected to:
  - reduce very considerably (by >1%), in the past there has been >1% reduction in landfill capacity;
  - end during construction and operation;
  - is already known to be unavailable; or,
  - would require new capacity or infrastructure to be put in place to meet forecast demand.

15.5 Development Design and Impact Avoidance

15.5.1 Throughout the EIA, where applicable, the way that likely environmental effects have been or would be avoided, prevented, reduced or offset through design and/ or management measures are described. These are measures that are inherent in the design (also known as 'primary measures') and construction of the Proposed Developments (also known as 'embedded measures'). Other embedded measures are required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/ or standard sectoral practices (also known as 'tertiary mitigation'). Some of these embedded measures have been identified and are described below.

15.5.2 The Proposed Developments will aim to prioritise waste prevention, followed by preparing for re-use, recycling and recovery and lastly disposal to landfill as per the waste hierarchy, illustrated in Plate 15.3.

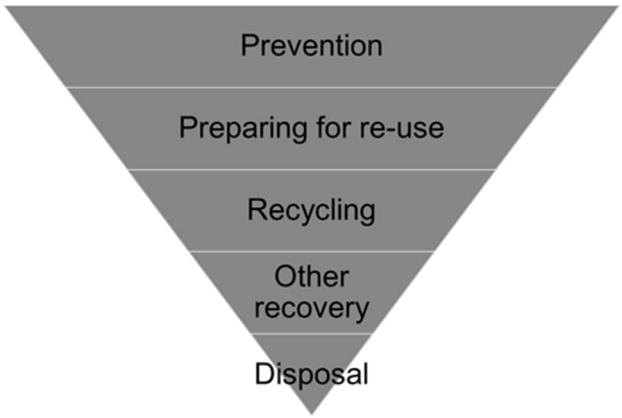

Plate 15.3: The waste hierarchy, from Defra's Guidance on Applying the Waste Hierarchy, recreated by AECOM (DEFRA, 2011)

15.5.3 The following mitigation measures have been considered and implemented where applicable during the design phases and subsequent construction work:

- design for reuse and recovery: identifying, securing and using materials that already exist on site, or can be sourced from other projects;
- design for materials optimisation: simplifying layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content;
- design for off-site construction: maximising the use of pre-fabricated structure and components, encouraging a process of assembly rather than construction;

- design for the future (deconstruction and flexibility): identify how materials can be designed to be more easily adapted over an asset lifetime and how deconstructability and demountability of elements can be maximised at end of first life;
- design for waste and material asset efficient procurement: identify and specify materials that can be acquired responsibly, in accordance with a recognised industry standard; and
- engineering plan configurations and layouts that show how the most effective use of materials and arisings can be achieved.

15.5.4 The construction of the Proposed Developments is subject to measures and procedures defined within a Code of Construction Practice (CoCP). The CoCP includes the implementation of industry standard practice and control measures for environmental impacts arising during construction, such as the control of dust and the approach to waste management on site. An Outline Construction Environmental Management Plan (CEMP) for the Proposed Developments is included in ES (Volume II Appendix 4A), and the appointed construction contractors for each of the Proposed Developments will use this document to produce their CEMPs (including a Site Waste Management Plan (SWMP)) prior to construction works commencing.

15.5.5 If required, a Materials Management Plan (MMP) will be developed under the CL:AIRE Definition of Waste: Development Industry Code of Practice by the appointed construction contractors to support the re-use of excavated materials, minimise off-site disposal; and to demonstrate the necessary lines of evidence to support the proper reuse/offsite disposal of materials and ensure compliance with regulatory guidance.

15.5.6 Embedded measures have been considered prior to the assessment of effects to avoid considering assessment scenarios that are unrealistic in practice, i.e. do not take account of such measures even though they are likely to be standard practice (tertiary mitigation) and/ or form part of the design of the Proposed Developments (primary mitigation). These have then been followed through the assessment to ensure that realistic likely environmental effects are identified. Where likely significant adverse effects are identified after considering these embedded measures, 'additional mitigation measures' have been considered, developed and proposed, where possible (see Section 15.7).

15.5.7 All embedded mitigation is described within the ES with the rationale for the inclusion of the identified embedded measures clearly stated.

15.6 Likely Impacts and Effects of the Proposed Developments

15.6.1 This section identifies the likely impacts and effects resulting from the Proposed Developments. The magnitude of impacts are defined with reference to the relevant baseline conditions, and effects are determined in accordance with the identified methodology.

15.6.2 The technical assessments identify the environmental impacts of the Proposed Developments at key stages in construction and operation.

15.6.3 There are several scenarios being considered for the construction of the Proposed Developments. The assessment scenarios that will be considered for the purposes of the EIA (and considered in the ES) are as follows:

- **Existing Baseline** without the Proposed Developments - the year that the baseline data has been collected (year dependent of data source);
- **Construction** of the Proposed Developments; and
- **Opening** and/ or **Operation** (including maintenance) of the Proposed Developments - where opening represents the start of operation.

15.6.4 It has not been possible to set a future baseline for materials and waste, and decommissioning is scoped out of the assessment (as detailed in Section 15.3). The following scenarios are therefore not considered in this assessment:

- **Future Baseline** without the Proposed Developments - for comparison respectively with the construction and operation scenarios described below; and
- **Decommissioning** of the Proposed Developments.

15.6.5 The prediction of impacts and the assessment of effects (and their significance) in relation to materials and waste associated with construction and operation of the Proposed Developments has taken account of the effectiveness of both the embedded and essential mitigation measures summarised in Section 15.5.

15.6.6 Where applicable the assessment reports the temporary and permanent impacts and effects on materials and waste that would be directly or indirectly affected by the Proposed Developments by virtue of their proximity to the works, or through a shared relationship or inter-dependency.

Construction Phase

15.6.7 Table 15.22 summarises the likely types of materials that will be used and wastes that are likely to be generated during the construction of the Proposed Developments.

Table 15.22: Construction material use and waste types arising from the construction of the Proposed Developments

Construction Activity	Materials Used	Waste Types Generated
Site remediation/ preparation/ earthworks	• Fill material for construction purposes. • Primary/ secondary/ recycled aggregates for ground stabilisation. • Topsoil and subsoil for landscaping and restoration.	• Surplus excavated materials. • Surplus topsoil and subsoil. • Unsuitable and contaminated soils and excavated materials. • Vegetation from site clearance. • Clearance of other materials.
Demolition	• Materials are not required for demolition works.	• Waste arisings from the required demolition of existing buildings and assets (Phillips 66 Proposed Development only).
Site construction	• Main construction materials including: • Aggregates • Asphalt and bituminous materials • In-situ cast concrete • Precast concrete products (structural components, kerbs, drainage pipes, chambers and channels)	• Excess, offcuts and broken/ damaged construction materials. • Existing infrastructure removed during works. • Packaging from materials delivered to site. • Construction worker wastes from offices and welfare areas / canteens. • Waste oils from construction plant.

Construction Materials

The estimated main types and quantities of materials anticipated to be used during construction of the Proposed Developments have been obtained from the respective design teams for the Proposed VPI Development and the Proposed Phillips 66 Development, as presented in Table 15.23 and

15.6.8 Table 15.24. The tables also include potential material wastage. It is not anticipated that the demolition or excavation will require a large quantity of construction material use.

15.6.9 The following data is sourced from the WRAP's Designing Out Waste Tool for Civil Engineering (WRAP, undated c):

- Data on the bulk density of materials has been used to convert quantities between volume (m^3) and weight (tonnes) where required; and
- The estimated wastage rates for each material are based on the 'good practice' rates.

Table 15.23: Construction materials for the Proposed VPI Development

Construction Material Category	Material Density	Quantity		Wastage Rate	Wastage	
	(Tonnes/m^3)	m^3	Tonnes	%	m^3	Tonnes
Imported 6F2 material	1.9	128,096	243,382	5	6,405	12,169
Type 1 crushed aggregate	1.9	35,226	66,929	5	1,761	3,346
Steelwork	Conversion to m^3 not required since no wastage anticipated	-	3,400	0	-	-
Pipework	Conversion to m^3 not required since no wastage anticipated	-	5,020	0	-	-
Concrete	2.4	17,708	42,500	5	885	2,125
Copper	Conversion to m^3 not required since no wastage anticipated	-	230	0	-	-
Vessels	Conversion to m^3 not required since no wastage anticipated	-	2,800	0	-	-
Total			**364,264**		**9,052**	**17,641**

Table 15.24 Construction materials for the Proposed Phillips 66 Development

Construction Material Category	Material Density	Quantity		Wastage Rate	Wastage	
	(Tonnes/m³)	m³	Tonnes	%	m³	Tonnes
Steelwork	Conversion to m³ not required since no wastage anticipated	-	2,119	0	-	-
Pipework	Conversion to m³ not required since no wastage anticipated	-	763	0	-	-
Concrete	2.4	3,200	7,680	5	160	384
Copper	Conversion to m³ not required since no wastage anticipated	-	600	0	-	-
Vessels	Conversion to m³ not required since no wastage anticipated	-	1,790	0	-	-
Total			**12,952**		**160**	**384**

15.6.10 For the construction of the Proposed VPI Development no individual construction material is equal or greater than 1% by weight of the baseline consumption (UK/GB) (aggregates 0.26%, steel 0.02% and concrete 0.05%). The sensitivity of the receptor is classified as 'low' (as per Table 15.4) and the magnitude of impact is considered to be 'negligible' (as per Table 15.7), this is assessed to result in a **neutral/ slight adverse (not significant) effect**.

15.6.11 For the construction of the Proposed Phillips 66 Development no individual construction material is equal or great than 1% by weight of the baseline consumption (UK/GB) (steel 0.01%, concrete 0.01%). The sensitivity of the receptor is classified as 'low' (as per Table 15.4) and the magnitude of impact is considered to be 'negligible' (as per Table 15.7), this is assessed to result in a **neutral/ slight adverse (not significant) effect**.

15.6.12 Since all construction materials estimates are not available for the construction of the Proposed Phillips 66 Development and Proposed VPI Development at this time of writing e.g. will be refined by the Principal Contractors, it is not possible to compare all material quantities against the baseline consumption. However, it is not anticipated that any individual construction material will be equal or greater than 5% by weight of the baseline consumption, therefore, the magnitude is considered to be 'minor' as per Table 15.7. The sensitivity of the receptor is classified as 'low' (as per Table 15.4), therefore 'the impact is assessed to result in a **neutral/ slight adverse (not significant) effect**.

Construction Waste

15.6.13 Since material quantities for all construction materials are not yet available, the estimates based on total wastage from construction material is likely to be an underestimation and is not used in the assessment. Therefore, construction waste has also been estimated based on capital cost of the Proposed Developments.

15.6.14 The high-level estimate of construction waste (excluding demolition and excavation) has been calculated based on the capital expenditure for the Proposed VPI Development and the

Proposed Phillips 66 Development and a published benchmark based on average m^3 of waste per £100,000 (WRAP, undated d). The best practice benchmark for industrial buildings is 5.5 m^3 of waste per £100,000. A conversion factor of 1.497 tonnes/m^3 (Construction Resources and Waste Platform, 2010) has been used to convert m^3 into tonnes. The best practice benchmark has been used since waste generation is expected to be at the lower end of the scale since much of the capital expenditure will be associated with modular process engineering components which will be manufactured off-site, and hence the on-site waste generation from assembly of these components is expected to be relatively small.

15.6.15 Estimated construction waste for the Proposed VPI Development is 55,000 m^3 (85,335 tonnes) based on a capital expenditure of £1 billion.

15.6.16 Estimated construction waste for the Proposed Phillips Development is 17,600 m^3 (26,347 tonnes) based on a capital expenditure of £320 million.

Demolition Waste

15.6.17 Limited demolition will be required for the construction of the Proposed VPI Development and Proposed Phillips 66 Development. Where demolition is required the quantities of demolition waste are anticipated to be small compared to the main construction wastes and are not included in the assessment. Demolition waste is likely to have a high potential recovery rate.

Excavated Material

15.6.18 Excavated material is not included in the construction waste estimates or when calculating the overall waste recovery rate, since where possible the material would be reused on site and hence will not be categorised as a waste. Waste recovery targets do not include excavated material (uncontaminated excavated soil and stones, EWC code 17 05 04). This approach is consistent with the waste hierarchy and the objectives of minimising waste generation and reusing materials.

15.6.19 The Proposed VPI Development and Proposed Phillips 66 Development designs are currently being progressed to optimise the requirements for cut and fill, and where possible, this will be minimised to reduce the import and export of materials and waste.

15.6.20 The cut and fill is anticipated to be balanced for the Proposed Phillips 66 Development with no offsite management of material.

15.6.21 The cut and fill is anticipated to be unbalanced for the Proposed VPI Development with a total of 133,500 m^3 of material requiring offsite management.

Table 15.25: Construction, demolition and excavation waste summary

Activity	Waste (m^3)
Construction of the Proposed Phillips 66 Development	17,600
Construction of the Proposed VPI Development	55,000
Demolition of the Proposed Phillips 66 Development	Negligible with high anticipated recovery rate
Demolition of the Proposed VPI Development	Negligible with high anticipated recovery rate
Excavation of the Proposed Phillips 66 Development	Not applicable cut and fill balanced
Excavation of the Proposed VPI Development	133,550
Total construction, demolition and excavation waste of the Proposed Phillips 66 Development	**17,600**
Total construction, demolition and excavation waste of the Proposed VPI Development	**188,500**

15.6.22 Total construction waste (construction, demolition and excavation) for the Proposed Phillips 66 Development is 17,600 m^3. A worst-case scenario where all waste is disposed of to landfill has been applied. This equates to 0.01% of the 127 million m^3 of inert and non-hazardous landfill capacity within the waste management study area (East Midlands and Yorkshire and the Humber regions).

15.6.23 In practice a large proportion of non-hazardous and inert waste from the Proposed Phillips 66 Development is likely to be recovered rather than disposed of to landfill, further reducing the overall quantities of waste for disposal. With a recovery rate of 70% the percentage of landfill capacity required would reduce to 0.004% with a recovery rate of 90% the percentage of landfill capacity required would reduce to 0.001%.

15.6.24 Based on the above, construction of the Proposed Phillips 66 Development would result in less than a 1% reduction of landfill capacity within the waste management study area.

15.6.25 Accordingly, for non-hazardous waste the sensitivity of the receptor is classified as 'very high' (as per Table 15.5 and paragraph 15.4.29) and the magnitude of impact is considered to be 'negligible' (as per Table 15.8), this is assessed to result in a **slight adverse (not significant) effect**.

15.6.26 Total construction waste (construction, demolition and excavation) for the Proposed VPI Development is 188,500m^3. A worst-case scenario where all waste is disposed of to landfill has been applied. This equates to 0.1% of the 127 million m^3 of inert and non-hazardous landfill capacity within the waste management study area (East Midlands and Yorkshire and the Humber regions).

15.6.27 In practice a large proportion of non-hazardous and inert waste from the Proposed VPI Development is likely to be recovered rather than disposed of to landfill, further reducing the overall quantities of waste for disposal. With a recovery rate of 70% the percentage of landfill capacity required would reduce to 0.04% with a recovery rate of 90% the percentage of landfill capacity required would reduce to 0.01%.

15.6.28 Based on the above, construction of the Proposed VPI Development would result in less than a 1% reduction of landfill capacity within the waste management study area.

15.6.29 Accordingly, for non-hazardous waste the sensitivity of the receptor is classified as 'very high' (as per Table 15.5 and paragraph 15.4.29) and the magnitude of impact is considered to be 'negligible' (as per Table 15.8), this is assessed to result in a **slight adverse (not significant) effect**.

15.6.30 At this stage no estimate of hazardous waste generation during construction has been undertaken. The quantities of hazardous waste e.g. oils, batteries, aerosol cans etc. are anticipated to be small compared to the overall construction waste arisings and anticipated to be less than 0.1% of the hazardous waste landfill capacity (12,107 m^3). Many hazardous waste types have well defined waste management routes including recovery and are unlikely to be sent directly to landfill. Procedures for the storage and management of these wastes will be set out in the Principal Contractors' SWMPs. Accordingly, for hazardous waste the sensitivity of the receptor is classified as 'very high' (as per Table 15.6 and paragraph 15.4.29) and the magnitude of impact is considered to be 'negligible' (as per Table 15.9), this is assessed to result in a **slight adverse (not significant) effect**.

15.6.31 Construction site operations will also generate waste streams from temporary offices, welfare facilities, material packaging and construction plant maintenance. The quantities are anticipated to be small compared to the main construction wastes and are not included in this assessment. Procedures for the storage and management of these wastes will be set out in the Principal Contractors' SWMPs.

Operation Phase

15.6.32 Operational waste from the Proposed Developments will comprise:

- waste from site offices; and

- waste from the PCC plants.

15.6.33 Table 15.26 below summarises the main waste types and quantities.

15.6.34 The largest operational waste arisings would be from the PCC plants. It has been conservatively assumed at this stage in the project development that all wastes from the PCC plants will be hazardous and this assessment is based on that assumption. In the event that some of the PCC plants' waste streams are non-hazardous, impacts of operational waste management at the Proposed Developments will be lower than those presented in this assessment.

Table 15.26: Operational waste arisings

Waste Type	Proposed Development	Source and Description	Waste Classification	Estimated Quantity
General commercial waste	Phillips 66 and VPI	Offices, recyclables such as paper, cardboard and plastic, food waste etc.	Non-hazardous	Phillips 66 - minimal VPI - minimal
Industrial waste	Phillips 66 and VPI	• general maintenance activities, predominantly: • paper, cardboard, plastic and wooden packaging material; • worn and damaged metal items; • various other materials, gaskets etc; and a small amount of waste oil. Waste oil will be classified as hazardous waste, whereas the other waste is likely to be classified as non-hazardous.	Non-hazardous and hazardous	Phillips 66 550 tonnes per year (based on current waste) VPI 379 tonnes per year (based on current waste +30%)
O_2 removal catalyst	VPI	Expected to be replaced every 4-6 years. Will be removed and recycled/ disposed of by specialist contractor. Solid	Assumed as a worst case to be hazardous.	14 m^3 every 4- 6 years
Dehydration desiccant	VPI	Expected to be replaced every 4-6 years. Will be removed and recycled/ disposed of by specialist contractor. Solid	Assumed as a worst case to be hazardous.	24 tonnes every 4-6 years

Waste Type	Proposed Development	Source and Description	Waste Classification	Estimated Quantity
Solvent drain vessel solvent	VPI	Solvent that cannot be re-used in the process is dispatched off-site via vacuum truck. Liquid	Likely to be hazardous.	Periodically, quantity not yet known.
Reclaimer waste (degraded solvent)	VPI	Degraded solvent is periodically loaded onto trucks for disposal of off-site by a third party. Equivalent continuous production rate for degraded amine 315kg/h Liquid	Likely to be hazardous.	2,760 tonnes annual equivalent continuous production rate for degraded amine solvent.
Activated carbon	VPI	Periodic replacement. It is anticipated that this will be removed and disposed of off-site by a specialist contractor. Solid	Assumed as a worst case to be hazardous.	57m^3 every 6-12 months.
Filter elements	VPI	Periodic replacement. It is anticipated that this will be removed and disposed of off-site by a specialist contractor. Solid	Assumed as a worst case to be hazardous.	Periodically, to be confirmed during EPC.
Wet scrubber waste	Phillips 66	Solid	Assumed as a worst case to be hazardous.	1,300 tonnes per year
Reclaimer waste (degraded solvent)	Phillips 66	Liquid	Assumed as a worst case to be hazardous.	300 tonnes per year
Dry catalyst fines	Phillips 66	Solid	Assumed as a worst case to be hazardous.	300 tonnes per year

15.6.35 The IEMA 'Guide to Materials and Waste in Environmental Impact Assessment' recommends assessing impacts of hazardous waste with reference to the available landfill capacity nationally.

15.6.36 For the Proposed VPI site based on current design understanding, the hazardous waste streams that may be suitable for landfill disposal are O_2 removal catalyst, dehydration desiccant and carbon bed filter media which are assumed to be solids or sludge. The majority of industrial waste is assumed to be solid and as a worst case hazardous. At this time O_2 removal catalyst (14 m^3 every 4-6 years) and dehydration desiccant (24 tonnes every 4-6

years) and industrial waste (379 tonnes) have been estimated. In the event that these wastes are disposed of to landfill, the annual quantity is likely to be a reduction of <0.1% (12,107 m^3) of national hazardous waste landfill void capacity is considered to be of negligible magnitude. Accordingly, for hazardous waste the sensitivity of the receptor is classified as 'very high' (as per Table 15.6) and the magnitude of impact is considered to be 'negligible' (as per Table 15.9), this is assessed to result in a **slight adverse (not significant) effect**.

15.6.37 Based on current design understanding, the hazardous waste streams that may not be suitable for landfill disposal are solvent drain vessel solvent and reclaimer waste (degraded solvent) which are liquids. At this time only reclaimer waste (degraded solvent) (2,760 tonnes per year) has been estimated.

15.6.38 If degraded solvents from the PCC plants are disposed of by high-temperature incineration, the wastes from the Proposed Development would be equivalent to 0.8% of 2021 hazardous waste incineration waste inputs (at the national level).

15.6.39 If degraded solvents from the PCC plants are managed by hazardous liquid waste facilities, the wastes from the Proposed Development would be equivalent to 0.4% of 2021 hazardous liquid waste treatment throughput (at the national level).

15.6.40 For the Proposed Phillips 66 site based on current design understanding, the hazardous waste streams that may be suitable for landfill disposal are wet scrubber waste and dry catalyst fines. The majority of industrial waste is assumed to be solid and as a worst case hazardous. At this time wet scrubber waste (1,300 tonnes per year) and dry catalyst fines (300 tonnes per year) and industrial waste (500 tonnes per year) have been estimated. In the event that these wastes are disposed of to landfill, the annual quantity is likely to be a reduction of <0.1% (12,107 m^3) of national hazardous waste landfill void capacity is considered to be of negligible magnitude. Accordingly, for hazardous waste the sensitivity of the receptor is classified as 'very high' (as per Table 15.6) and the magnitude of impact is considered to be 'negligible' (as per Table 15.9), this is assessed to result in a **slight adverse (not significant) effect**.

15.6.41 Based on current design understanding, the hazardous waste streams that may not be suitable for landfill disposal is reclaimer waste (degraded solvent) which is liquid. At this time only reclaimer waste (degraded solvent) (300 tonnes per year) has been estimated.

15.6.42 If degraded solvents from the PCC plants are disposed of by high-temperature incineration, the wastes from the Proposed Development would be equivalent to 0.08% of 2021 hazardous waste incineration waste inputs (at the national level).

15.6.43 If degraded solvents from the PCC plants are managed by hazardous liquid waste facilities, the wastes from the Proposed Development would be equivalent to 0.05% of 2021 hazardous liquid waste treatment throughput (at the national level).

Decommissioning Phase

15.6.44 Decommissioning is scoped out of the assessment.

15.7 Mitigation and Enhancement Measures

15.7.1 As no materials and waste significant effects have been identified, no further or additional mitigation is proposed.

15.8 Residual Effects and Conclusions

15.8.1 Effects of the Proposed Developments remaining following the implementation of available mitigation measures are known as 'residual effects'.

15.8.2 There are no residual effects resulting from the Proposed Developments, potential effects are summarised in Table 15.27 and Table 15.28 below.

Table 15.27: Summary of effects VPI

Phase	Description of Effect	Significance of Effect (Before Mitigation)	Mitigation Measures	Significance of Effect (After Mitigation)	Duration (short/ medium/ long term) and Reversibility
Construction	Changes in demand for materials	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
	Changes in available landfill void capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
Operation	Changes in available landfill void capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
	Changes in available hazardous waste management facility capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
Decommissioning	Scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment

Table 15.28 Summary of Effects Philips 66

Phase	Description of Effect	Significance of Effect (Before Mitigation)	Mitigation Measures	Significance of Effect (After Mitigation)	Duration (short/ medium/ long term) and Reversibility
Construction	Changes in demand for materials	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
	Changes in available landfill void capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
Operation	Changes in available landfill void capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible

Phase	Description of Effect	Significance of Effect (Before Mitigation)	Mitigation Measures	Significance of Effect (After Mitigation)	Duration (short/ medium/ long term) and Reversibility
	Changes in available hazardous waste management facility capacity	Slight adverse (not significant) effect	Not applicable no significant effect	Slight adverse (not significant) effect	Short term, irreversible
Decommissioning	Scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment	Not applicable scoped out of the assessment

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