17 Materials

This chapter considers the impacts of the proposed scheme and outlines mitigation in relation to the use of material resources and the management of waste.

By applying key material and waste management principles, such as the waste management hierarchy, the effects on natural resources and need for permanent disposal of wastes would be reduced. In particular, this would be achieved by re-using existing soils and redundant material where possible, taking into consideration the environmental impacts of products during their procurement, and sourcing materials from local suppliers.

The potential for impacts on materials or waste disposal facilities is related to the performance of the contractor during completion of the construction works. Any surplus materials or waste sent off site could have a resultant impact on the available waste management infrastructure and resources. The risk of such impacts occurring would be managed and reduced through the development and application of several plans addressing different aspects of construction site management, such as a Construction Environmental Management Plan (CEMP) and a Site Waste Management Plan (SWMP).

With the proper application of these management procedures, the residual significance of all of waste impacts described in this chapter are expected to be Slight or Neutral. Should contaminated soils be encountered during construction this could result in a Slight/Moderate adverse impact, however with appropriate mitigation (as detailed in Chapter 12: Geology, Soils, Contaminated Land and Groundwater) this is expected to be reduced through reuse or treatment where appropriate. The magnitude of the proposed scheme's carbon emissions during both the construction and operation phases would be Minor. All impacts on materials and waste are not predicted to be significant in the context of the EIA Regulations.

17.1 Introduction

17.1.1 The following chapter presents the results of the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) for the A9/A96 Inshes to Smithton scheme (hereafter referred to as the proposed scheme) in relation to impacts associated with the use of material resources and the management of waste. It outlines measures for mitigating these impacts where possible and describes any residual impacts that may occur with mitigation in place.

17.1.2 This assessment has been undertaken in line with the 'Detailed Assessment' method as stated in the draft DMRB Volume 11, Section 3, Part 6 HD212/11 Materials Chapter, amended as per conventions (Highways Agency, Scottish Government, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2012), and as agreed with Transport Scotland. Copies of the guidance are available from Highways England on request. The guidance (hereafter referred to as draft HD212/11) defines materials as comprising:

- *'the use and consumption of material resources for the construction, improvement and maintenance of roads; and*
- *the production and management of wastes resulting from the construction, improvement and maintenance of roads'.*

17.1.3 Draft HD212/11, Section 2.3 sets out that:

> '…*material resources encompasses the materials and construction products required for the construction, improvement and maintenance of the road network. Material resources include raw materials, such as aggregates and minerals from primary, secondary or recycled sources, and manufactured construction products*.'

17.1.4 It outlines that manufactured construction products can include the construction of road surfacing, bridges, gantries, signage, barriers, lighting and fencing. Some material resources for construction of the proposed scheme would originate off-site and some would arise on-site, such as excavated soils or recycled road planings and other recovered material from demolished buildings and carriageways. The production, sourcing, transport, handling, storage and use of these materials, as well as the disposal of any surplus, have the potential to adversely affect the environment.

17.1.5 In considering material resource use and waste management, it is important to define when, under current legislation, a material is considered to be waste. Draft HD212/11 does not provide an

independent definition, however, the Waste Framework Directive (European Directive 2006/12/EC, as amended by Directive (2008/98/EC), hereafter referred to as the Waste Directive) (of which Annex II was replaced in December 2014 by Commission Regulation No 1357/2014) defines waste as: *'any substance, or object, which the holder discards or intends or is required to discard.'*

17.1.6 There are many ways in which material use and waste can potentially impact upon the environment, such as damage due to extraction, release of carbon during extraction and processing, the use of water in refinement, fuel use in transportation, leaching of contaminants during construction and use, and other issues associated with disposal and storage.

17.1.7 The use of material resources has been estimated based on the likely requirements of the DMRB Stage 3 assessment, as assessed and reported within this Environmental Impact Assessment Report (EIAR). The wastes likely to be generated by the proposed scheme are also outlined in this chapter.

17.1.8 The chapter is supported by the following appendices and figures which are cross referenced where relevant:

- Figure 17.1 (Operational Waste Management Sites);
- Appendix A17.1 (Key Materials, Waste Legislation); and
- Appendix A17.2 (Carbon Assessment).

17.1.9 By applying key material and waste management principles, such as the waste management hierarchy, the effects on natural resources and the need for permanent disposal of wastes would be minimised. This would be achieved by re-using existing soils and redundant material wherever practicable, by taking into consideration the environmental impacts of products during their purchase, and by sourcing materials from local suppliers as much as possible. 'Whole life' carbon emissions associated with construction and maintenance of the proposed scheme have also been assessed in Section 17.5 (Carbon Assessment).

17.1.10 The potential for residual impacts on material resources or waste treatment and disposal facilities is principally related to the performance of the contractor during completion of the construction works. Any surplus materials or waste sent off site could have a resultant impact on the available waste management infrastructure and resources. The risk of such impacts occurring would be managed and where possible reduced through the development and application of several plans addressing different aspects of construction site management, including the Construction Environmental Management Plan (CEMP) and a Site Waste Management Plan (SWMP) see Section 17.7 (Mitigation).

17.1.11 Further considerations related to the Materials Assessment are addressed separately within other chapters. Section 2.30 of draft HD212/11 advises that there should be '*appropriate liaison between specialists working on the respective topic areas*'. The most significant inter-relationship with the materials topic is with soils and geology, given the understanding required regarding the nature of the materials. The interrelationships also include dust, noise and traffic movement associated with demolition activities (if required), the collection and removal of waste, and the supply of materials.

17.1.12 While the use of materials and the production of waste can affect the full range of environmental media and assessment topics, their effect on the wider environment has been assessed within each of the other technical chapters in this EIAR, as follows:

- Soils and contaminated lands: the link between this topic and the materials chapter includes the classification of contaminated soils, remediation of contaminated soils, on site treatment of contaminated soils and re-use of excavated sub strata and soils. Please see Chapter 12 (Geology, Soils, Contaminated Land and Groundwater).
- Surface water environment: there are a number of sensitive environments in the vicinity of the proposed scheme, including Cairnlaw Burn (Surface Water Feature (SWF) 08) and its tributary, Tower Burn (SWF 10). For more baseline information please see Chapter 11 (Ecology and Nature Conservation) and Chapter 13 (Road Drainage and the Water Environment).
- Groundwater resources: the groundwater within the proposed scheme area was classified by the Scottish Environment Protection Agency (SEPA) as having a 'Good' water quality and

overall classification of 'Good' in 2014. See Chapter 12 (Geology, Soils, Contaminated Land and Groundwater), and Chapter 13 (Road Drainage and the Water Environment).

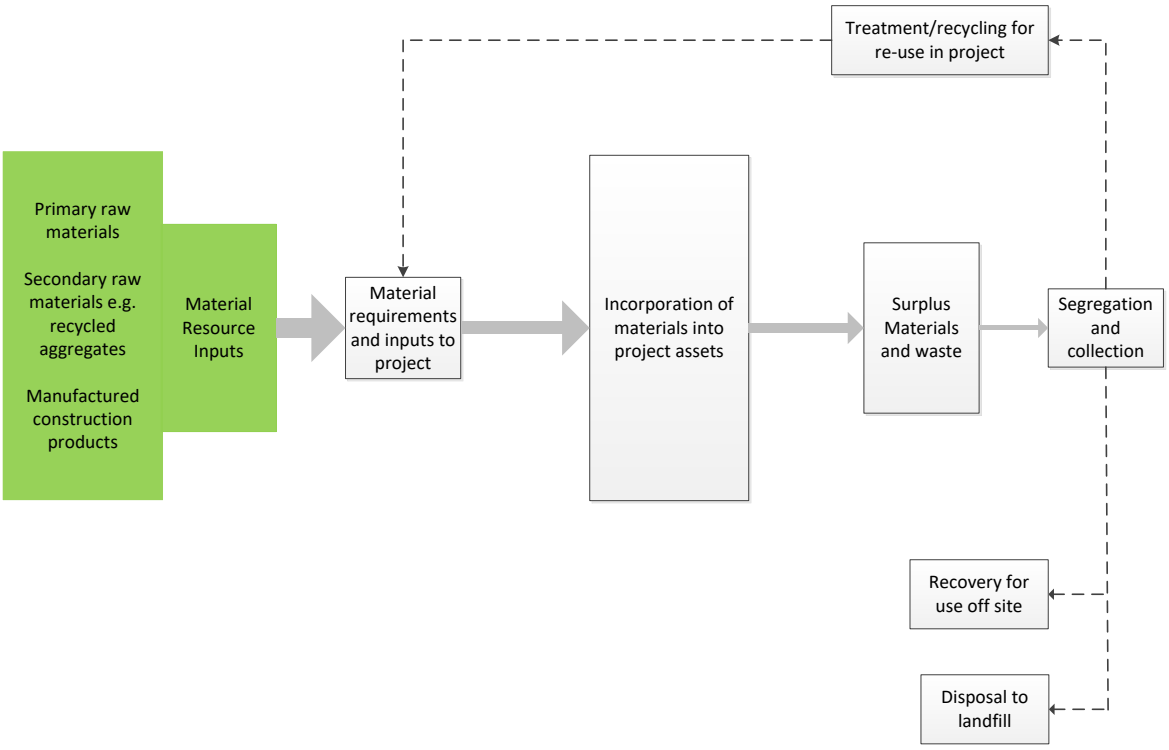
- Humans, particularly local residents, and commercial businesses are considered in Chapter 7 (Air Quality), Chapter 8 (Noise and Vibration) and Chapter 15 (People and Communities: Community and Private Assets).
- Wildlife and its habitats: information on habitats and protected species is provided in Chapter 11 (Ecology and Nature Conservation) and associated appendices and figures.
- Global climate and greenhouse gas emissions are considered in Chapter 7 (Air Quality).

17.2 Methodology

Approach to the Assessment

17.2.1 Environmental impacts associated with material resources and wastes occur at each stage of the project's material flow cycle. Draft HD212/11 does not include a specific materials resource flow diagram, however the supplementary guidance IAN 153/11 Guidance on the Assessment of Material Resources (Highways Agency 2011) provides a useful diagram recreated in Diagram 17.1. This presents a simplified materials resource flow and is still relevant for the purposes of this assessment.

Diagram 17.1: A Project's Material Flow Cycle (recreated from IAN153/11 (Highways Agency 2011))



17.2.2 The Materials Assessment contained within this chapter has been largely based on the guidance contained within draft HD212/11 which acknowledges that most roads projects are likely to result in the production of waste. The waste primarily comes from two sources:

- '*existing site materials, such as excavation of materials from earthworks and concrete, brick or stone from the demolition of existing structures or road planings; and*
- *materials brought onto site but not used for the original purpose, including damaged materials, off cuts and materials surplus to demand'.*

17.2.3 The assessment of materials is yet to be incorporated into current DMRB guidance, however this assessment follows draft guidance on the scope of the 'Materials' topic and the approaches / methodologies to be applied as stated in draft HD212/11. Due to the fact that the proposed scheme

has the potential for environmental effects associated with material use and waste production, this assessment follows the detailed assessment method as stated in draft HD212/11 to consider the materials and waste aspects of the proposed scheme and aims to identify and quantify the following:

- the types and quantities of materials required for the project;
- details of the source / origin of materials, including site-won materials to replace virgin materials;
- the cut and fill balance;
- the types and quantities of forecast waste arisings, including any hazardous waste (known as 'special waste' in Scotland);
- surplus materials and waste falling under regulatory controls;
- waste that requires storage on-site prior to re-use, recycling or disposal;
- waste to be pre-treated and/or disposed of off-site;
- the impacts that would arise in relation to materials and waste;
- a discussion of the sensitivity of receptors, and the magnitude, nature and significance of those impacts; and
- identification of measures to mitigate impacts.

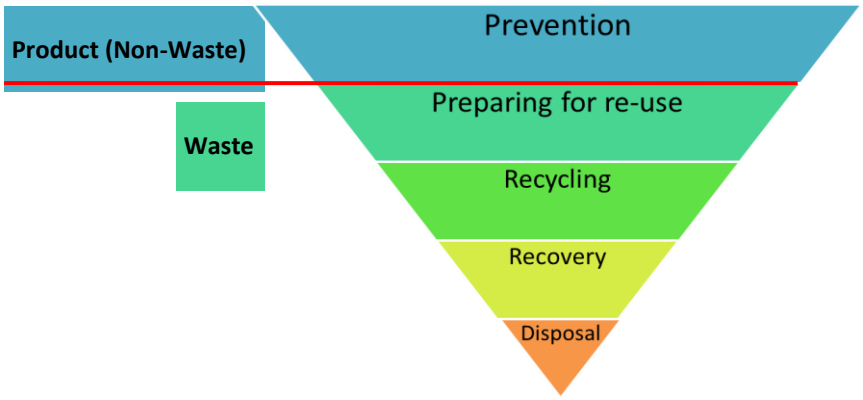
17.2.4 This chapter focuses primarily on the assessment of construction impacts arising from the transport, storage and use of material resources within the construction site, and the production, movement, transport, processing and disposal of wastes. An assessment of the operational impacts is also undertaken and these are likely to arise from routine maintenance and usage. Maintenance impacts can include waste materials from road sweeping, clearing of blocked gullies and drains, green waste from grass cutting and landscape maintenance, and the replacement of signage and lighting. Usage impacts can arise from accidental spillages on the highway during the operational phase, potentially contaminated runoff, and traffic debris including litter and tyres.

17.2.5 Draft HD212/11 states that ongoing operational and maintenance impacts should be considered at this stage of the assessment through the mechanism of calculating the potential carbon dioxide equivalent (CO_2e) impacts of the project. As such a carbon assessment has been undertaken for the proposed scheme taking into account the embodied carbon associated with the materials used, the transport of materials and waste, site plant energy consumption, any operational energy and emissions associated with structural maintenance. This assessment has been carried out utilising Transport Scotland's Carbon Management System (CMS) Project Tool (Transport Scotland 2016). Transport Scotland developed and implemented a CMS as a suite of tools to measure the Scope 1, 2 and 3 carbon emissions associated with their construction and maintenance activities across their road and rail schemes. Population of the CMS provides a systematic approach to ensure that all aspects of the design are considered during the assessment. The results of this assessment are presented in Section 17.5 (Carbon Assessment).

Legislative and Policy Background

17.2.6 Waste management is structured around a 'waste hierarchy' which defines the order of preference of the various waste management options. Diagram 17.2 illustrates the waste hierarchy as per the Waste Directive.

Diagram 17.2: The Waste Hierarchy



17.2.7 The waste hierarchy ranks waste management options according to what is best for the environment. It gives top priority to preventing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then recovery, and last of all disposal (e.g. landfill).

17.2.8 Generally, all relevant waste and resources management legislation and policy drivers aim to increase the efficiency of resource use, minimise waste, maximise the re-use/recycling/recovery of waste and reduce carbon emissions.

17.2.9 Chapter 18 (Policies and Plans) and Appendix A18.1 (Planning Policy Context for Environmental Assessment) describe the planning policies and guidance from national to local level which are relevant to materials. An assessment of the compliance of the proposed scheme against all development plan policies relevant to this environmental topic is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) with a summary overview provided in Section 18.4 (Assessment of Compliance) of Chapter 18 (Policy and Plans). Appendix A17.1 (Key Materials and Waste Legislation) of this chapter provides supplementary information with regard to additional legislation, plans and guidance as they relate to this Materials Assessment.

Study Area

17.2.10 This assessment defines two geographical boundaries for the study areas. The first boundary is limited to the individual footprint of the proposed scheme within which materials would be used and wastes generated and stored prior to off-site management. Land that may be used temporarily during construction has not been included as this information is not yet known; however, such temporary land may include construction compounds, temporary storage areas for soils and other materials, land for temporary construction site drainage, and haul roads. The second boundary encompasses The Highland Council area for the locations of source materials and waste management infrastructure. Moray and Aberdeenshire Council areas, have been included for regional context.

Impact Assessment

17.2.11 Details and indicative quantity estimates of materials and wastes have been prepared, based on the DMRB Stage 3 assessment. For the purposes of this assessment the quantification of materials has been based on a likely worst-case scenario and includes a 10% contingency of material and waste volumes to cover unknown items. The assessment of potential impacts has been undertaken with consideration of:

Materials

- regulatory and policy requirements;
- information about construction methods and techniques in relation to materials;
- materials recycling/re-use within the proposed scheme; and

- types and quantities of construction materials and products required for each phase of the proposed scheme.

Waste

- regulatory and policy requirements;
- the waste hierarchy (prevention, preparing for re-use, recycling and recovery);
- types, locations and capacities of identified waste management facilities (including disposal sites); and
- types, quantities and classification of waste forecast to be produced at each phase of the project, including disposal routes.

17.2.12 Impacts can be adverse, beneficial; direct, indirect; short-term, medium-term or long-term; temporary or permanent, and cumulative as defined in draft HD212/11.

17.2.13 Direct impacts are '*those that arise as straightforward consequences of the scheme*'. Examples of this would be the use of non-renewable material resources from primary sources (e.g. virgin sand or gravel from a quarry), or the production of hazardous / special waste which requires treatment and disposal in suitable permitted waste management facilities, such as contaminated soils.

17.2.14 Indirect (or secondary) impacts are defined as '*impacts arising from the scheme via a complex route, where the connection between the scheme and the impact is complicated, unpredictable or remote*.' These impacts include the embodied carbon emissions resulting from the extraction, manufacture and transport of materials, or the local environmental impacts associated with the extraction of a primary aggregate. Indirect impacts can be harder to quantify, but they are not necessarily less damaging than direct effects.

17.2.15 Temporary impacts are defined as '*short-term, medium-term or long-term but they are reversible; irreversible impacts are described as permanent*.' Short-term is normally considered to mean impacts that do not last longer than the construction period, whereas long-term impacts would persist beyond the end of the construction period throughout the maintenance of the asset.

17.2.16 Cumulative impacts can arise from multiple effects of the same scheme on a single asset, different multiple effects of the scheme and other schemes on the same asset, or incremental effects arising from a number of actions over time. Potential impacts in relation to other projects which may be constructed within a similar timeframe are considered further in Chapter 19 (Assessment of Cumulative Effects).

Assessment Criteria

17.2.17 The assessment of significance is based on the sensitivity of the receptor combined with the magnitude of the potential impact. Sensitivity, magnitude and significance criteria have been derived from guidance in draft HD212/11 following the detailed assessment reporting matrix as follows:

- embodied carbon emissions associated with the extraction, manufacturing and any pre-distribution transportation of the major material types likely to be used during construction (i.e. site won soils/rock and imported aggregates, asphalt, bitumen, concrete, metal, concrete and plastics products) have been estimated using Transport Scotland's CMS Projects Carbon Tool. The CMS Projects Carbon Tool has also been used to estimate operational maintenance materials;
- depletion of natural mineral resources has been estimated based on the quantities of key aggregate-using products (sub-base, base course, binder course, surface course, capping and drain filter/bedding materials etc.) to be used; and
- construction, demolition and excavation (CD&E) waste arisings have been estimated through a number of methods, including the application of material specific wastage rates to the materials identified for use in the proposed scheme and review of DMRB Stage 3 model requirements for earthworks quantities.

Embodied Carbon (Materials)

17.2.18 The magnitude of effects associated with material use has been derived from a calculation of embodied carbon associated with those materials known to be required for the construction and maintenance of the proposed scheme using the Transport Scotland Projects Carbon Tool.

17.2.19 Levels of magnitude, based on benchmark data from previous road projects, are defined as follows in Table 4.4 of draft HD212/11, and reproduced in Table 17.1.

Table 17.1: Materials (Carbon) Assessment Magnitude Criteria

Scale of Impact Magnitude	Total CO_2e of Materials (Tonnes)
No change	<1,000
Negligible	1,000 to 5,000
Minor	5,000 to 20,000
Moderate	20,000 to 40,000
Major	>40,000

Depletion of Natural Resources

17.2.20 The methodology in draft HD212/11 guidance does not include sensitivity criteria for materials use. For the purposes of this assessment the sensitivity of materials use has been estimated based on the availability of the resource in question and whether its use could result in its depletion. For example, high sensitivity might pertain to a rare resource that is not available locally or available locally in very limited amounts, such that the resource could be significantly depleted by its proposed use. Conversely, a low sensitivity resource may be considered as one that is very common locally or that primarily comprises recovered/recycled materials such that its use would contribute to waste reduction targets and the avoidance of the use of primary materials. Medium sensitivity would apply to materials somewhere between these two extremes.

17.2.21 Assessing the scale and significance of the potential impacts associated with the depletion of natural resources is based on a combination of quantities of mineral resources to be used by the proposed scheme, and the effects that the forecast consumption would have on the available minerals landbank. The assessment therefore reflects both the relative quantities of primary aggregates to be consumed and the sensitivity of regional mineral resources to further extraction. The value and/or sensitivity of the regional natural resource (sand and gravel, and crushed rock) is assigned as described in Table 17.2.

Table 17.2: Value / Sensitivity of regional natural resources (adapted from HD 212/11)

Sensitivity	Criteria
Very High	There are no supplies of mineral resources within the study area.
High	There are limited supplies of mineral resources within the study area.
Medium	There are adequate supplies of mineral resources within the study area
Low	There are good supplies of mineral resources within the study area.

17.2.22 Professional judgement has been used to determine the magnitude of impact for the depletion of natural resources against the scale provided in Table 17.3 below. This has been used in conjunction with the sensitivity to determine significance against the criteria set out in Table 17.6.

Table 17.3: Magnitude of impact for depletion of natural resources (based on professional judgement)

Magnitude	Criteria
Major	Considerable impact (by quantity) of more than local significance in relation to the use of mineral resources
Moderate	Moderate impact (by quantity) of more than local significance in relation to the use of mineral resources
Minor	Slight impact (by quantity) of more than local significance in relation to the use of mineral resources
Negligible	Negligible impact (by quantity) in relation to the use of mineral resources

Waste

17.2.23 The potential environmental effects associated with waste relate primarily to the waste management methods identified and the effects that the forecast waste arising will have on the capacity of available waste management infrastructure. Draft HD212/11 sets out that the assessment of impacts from the proposed scheme in relation to waste is through a combined assessment of the sensitivity of the receptor (e.g. waste management infrastructure) and the magnitude of impact in relation to the waste hierarchy, which provides the overall significance of impact.

17.2.24 Draft HD212/11 determines sensitivity based on capacity as outlined in Table 17.4.

Table 17.4: Waste Receptor Sensitivity Criteria

Sensitivity	Criteria
Very High	No available waste management capacity for any waste arising from the project.
High	Limited waste management capacity in relation to the forecast waste arisings from the project.
Medium	Adequate waste management capacity for the majority of wastes arising from the project.
Low	Adequate waste management capacity for all wastes arising from the project.

17.2.25 Magnitude is defined as per draft HD212/11 in Table 17.5.

Table 17.5: Waste Assessment Magnitude Criteria

Magnitude	Criteria
Major	Waste is predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation.
Moderate	Wastes are predominantly disposed of by incineration with energy recovery.
Minor	Wastes are predominantly segregated and sent for composting, recycling or further segregation and sorting at a materials recovery facility.
Negligible	Wastes are predominantly re-used on-site or at appropriately licensed or registered exempt sites elsewhere.

17.2.26 The nature of the impacts will be expressed as ‘adverse’ (a detrimental or negative impact to an environmental resource or receptor) or ‘beneficial’ (advantageous or positive), and the assessment of significance is derived by combining sensitivity and magnitude as set out in Table 17.6 (based on Table 4.5 of draft HD212/11).

Table 17.6: Waste Assessment Significance Criteria

Magnitude / Sensitivity	Negligible	Minor	Moderate	Major
Very High	Slight	Moderate/Large	Large/Very Large	Very Large
High	Slight	Moderate/Slight	Moderate/Large	Large/Very Large
Medium	Neutral/Slight	Slight	Moderate	Moderate/Large
Low	Neutral	Neutral/Slight	Slight	Slight /Moderate

Mitigation

17.2.27 Potential mitigation measures have been considered during this assessment and take into account best practice, legislation, guidance and professional experience. The specific mitigation measures in relation to the proposed scheme are discussed further in Section 17.7 (Mitigation).

Limitations of the Assessment

17.2.28 Baseline information, potential impacts and mitigation are described based on known information. The level of detail provided at this time is limited by the design information available to estimate material use and waste management requirements. For the purposes of this assessment the quantification of materials and waste has been based on the likely worst-case scenario drawn from

information currently available. This has included a 10% contingency to cover unknown items. Therefore, estimates would need to be refined at later stages in the design development process when further information is available during pre-construction preparation or during the construction period. Estimated quantities in this assessment can only be taken as approximate and indicative based on the DMRB Stage 3 assessment and available information.

17.2.29 In addition, some environmental impacts associated with the extraction and transport of primary raw materials and manufactured products would occur off-site. The source and processing/manufacture cannot be determined at this stage and the production of these materials is likely to have been subject to separate consent procedures (such as applications for planning permission and environmental permits), which may have included environmental assessment. Therefore, it is outside the scope of this assessment to consider the environmental impacts associated with the extraction of raw materials and the manufacture of products off-site. However, in accordance with draft HD212/11 it is within the scope of the assessment to consider the embodied carbon impacts associated with the extraction and manufacture of products prior to leaving the factory gate (termed 'cradle to gate').

17.2.30 Future changes to the permitted capacity of waste facilities during the construction of the proposed scheme cannot be identified at this stage, and it is also not certain what new capacity will become available during the lifetime of the project.

17.3 Baseline Conditions

Materials

17.3.1 There is capacity to supply minerals and aggregates from within The Highland Council and The Moray Council areas. The adopted Highland-Wide Local Development Plan (The Highland Council 2012) states that: *'the Council will seek to ensure that a landbank of approved reserves in each market area is sufficient at all times to meet the needs that are expected to arise in the following ten-year period'* (The Highland Council 2012, page 104).

17.3.2 The adopted Moray Local Development Plan (Moray Council, 2015) states under Policy ER4 that minerals will: '*ensure that there is a minimum 10 year landbank of permitted reserves for construction aggregates'* (Moray Council 2015, page 64).

17.3.3 A number of quarries in the area are being considered for the sourcing of aggregates, and it would be the intention that as much of the material as possible would be sourced from within the region. It would be up to the contractor appointed to source materials for the project and typically they would look to use local suppliers and to re-use materials on site to reduce costs. The use of such material would be controlled in accordance with specifications within the Manual of Contract Documents for Highway Works (MCHW) (Highways Agency 2014).

17.3.4 Table 17.7 lists a number of quarries that could potentially be used in the vicinity of the proposed scheme. These include Caledonian Quarry Products east of Blackcastle, Breedon Aggregates at Daviot (Breeden Asphalt Plant), and Leith's Quarry, Forres. Due to European Union competition regulations, it is not possible to prescribe materials sources; however, it can reasonably be inferred that there is likely to be an adequate supply of such aggregate from regional sources for the proposed scheme. Potential impacts in relation to other projects which may be constructed within a similar timeframe are considered further in Chapter 19 (Assessment of Cumulative Effects).

Table 17.7: Active Quarries in the Area of the Proposed Scheme

Quarry	Distance from Ashton Farm	Resource Available	Quantity Available
Mid Lairg Quarry (Daviot A Ross & Sons)	13km	Sand, Gravel, Road Base, and Recycled Aggregate	6,000 tonnes per day
Daviot Quarry (Breedon Aggregates)	13km	Asphalt	Not Known

Quarry	Distance from Ashton Farm	Resource Available	Quantity Available
Blackcastle Quarry – Tarmac (Caledonian Quarry Products)	20km	Sand and Gravel	160,000 tonnes Subject to planning permission for quarry extension
Balblair Quarry (Breedon Aggregates)	23km	Aggregate and Recycled Aggregate	Not Known
Achilty Quarry (Leith's)	33km	Aggregate and Recycled Aggregate	Not Known
Dalmagarry Quarry (Pat Munro)	36km	Sand and Gravel	1,000,000 tonnes Based on planning application committee report dated December 2014
New Forres Quarry (Leith's)	45km	Crushed Rock	Not Known
Granish Quarry (David Ritchie & Sons) - Aviemore	46km	Sand, Gravel, and Recycled Aggregate	Not Known
Clashach Quarry (Duffus)	60km	Sandstone	Not Known
Lochinver Quarry – Tarmac	60km	Sand and Gravel	Existing reserve = 39,000 tonnes + 3 million tonnes Based on approved planning application to Moray Council (11/01792/EIA)
Caysbriggs Quarry Lossiemouth - Tarmac	65km	Sand and Gravel	Not Known
Netherglen Quarry (Breedon Aggregates)	68km	Crushed Rock and Asphalt	Not Known
Limehilllock Quarry (Fochabers)	80km	Aggregate	Not Known

17.3.5 The Scottish Aggregates Survey 2012 published in 2015 by The Scottish Government confirms that 35% of the total production of hard rock, sand and gravel takes place in the Highland and Moray Council areas (approximately 43% of hard rock and 12% of sand and gravel).

17.3.6 Around 85 to 90% of crushed rock quarried was retained within the area where it was produced; however, the exception to this rule is the coastal quarry at Glensanda in The Highland Council area which primarily supplies markets outside Scotland and the United Kingdom. Only 6% of the hard rock produced in the Highlands and Moray stays in the region, although 96% of the sand and gravel produced is generally used locally. The report estimates that there is an average 29-year supply for hardrock in Scotland from active sites, and a further 14-years for sand and gravel.

17.3.7 Based on the quantities of material reserves available both from regional quarries and throughout Scotland, it can be reasonably inferred that the materials required for the proposed scheme would predominantly be available regionally.

Waste Management Infrastructure Capacity

17.3.8 When waste is created, priority is given to preparing it for reuse, then recycling, then recovery, and last of all disposal to permitted off-site facilities. Section 4.50 of draft HD212/11 sets out that the value/sensitivity of the available waste management infrastructure should be assessed within '*an appropriate radius of the site*'. The appropriate radius will depend on the geographical location of the site, as different regions have a varying number of waste management facilities with available capacity. Although the proposed scheme is relatively small when compared to other road schemes, its location affords access to waste management facilities within three council areas; therefore for the purposes of this assessment the study area encompasses the Highland, Moray and Aberdeenshire Council areas.

<u>Scotland</u>

17.3.9 The SEPA Waste Site and Capacity Report for Scotland 2017 (SEPA 2019a) identifies a total of 52 operational waste sites in The Highland Council area, 48 operational waste sites in Aberdeenshire,

and 10 in the Moray Council area. Table 17.8 details the annual capacity of these sites in 2017 (excluding sites that offer only civic amenity facilities and pet crematoria), the waste that was accepted in that year, and the remaining capacity at the end of 2017. The location of these sites is shown in Figure 17.1, as informed by SEPA's Scottish Waste Site and Capacity Interactive Tool (SEPA 2019b).

Table 17.8: Operational Waste Sites Permitted and Remaining Capacity in Highland, Moray and Aberdeenshire Council Areas (2017)

Waste Site Type	Operational Site Permitted Capacity (Tonnes / annum) 2017				Waste Accepted (2017)	Remaining Capacity (2017)
	Highland Council	Moray Council	Aberdeen -shire Council	Total	Total	Total
Civic amenity / Other treatment*	5,000	n/a	n/a	**5,000**	**3,500**	**1,500**
Civic amenity / Transfer station*	41,500	113,900	n/a	**155,400**	**64,750**	**90,650**
Civic amenity / Transfer station / Other treatment*	1,000	n/a	n/a	**1,000**	**85**	**915**
Composting	n/a	n/a	35,975	**35,975**	**20,050**	**15,925**
Incineration	105	n/a	n/a	**105**	**15**	**90**
Landfill	25,000	n/a	645,000	**670,000**	**302,245**	**367,755**
Landfill / Civic amenity*	n/a	122,000	n/a	**122,000**	**43,740**	**78,260**
Landfill / Civic amenity / Composting*	85,000	n/a	n/a	**85,000**	**54,740**	**30,260**
Landfill / Civic amenity / Other treatment*	26,000	n/a	n/a	**26,000**	**19,570**	**6,430**
Landfill / Other treatment	n/a	n/a	100,000	**100,000**	**68,100**	**31,900**
Landfill / Transfer Station / Other Treatment	n/a	n/a	100,000	**100,000**	**54,000**	**46,000**
Landfill / Transfer station / Composting / Other treatment	45,000	n/a	n/a	**45,000**	**19,835**	**25,165**
Metal recycler	9,650	27,250	54,600	**91,500**	**23,750**	**67,750**
Metal recycler / Transfer station	55,750	75,000	24,950	**155,700**	**61,160**	**94,540**
Metal recycler / Transfer station / Other treatment	87,000	n/a	n/a	**87,000**	**3,290**	**83,710**
Other treatment	32,100	n/a	205,000	**237,100**	**178,025**	**59,075**
Transfer station	354,200	n/a	541,750	**895,950**	**371,630**	**524,320**
Anaerobic Digestion	n/a	n/a	50,000	**50,000**	**58,645**	**- 8,645**
Transfer station / Anaerobic digestion	4,025	n/a	n/a	**4,025**	**850**	**3,175**
Transfer station / Composting	50,000	20,800	n/a	**70,800**	**57,510**	**13,290**
Transfer station / Other treatment	79,000	n/a	512,000	**591,000**	**175,055**	**415,945**
*sites without Civic amenity will be used in preference.						

17.3.10 According to the SEPA Waste Site and Capacity Tool (accessed 7 January 2019), the total quantity of controlled waste disposed to landfill in Scotland in 2017 was 3,826,658 tonnes. In 2017 there were 51 operational landfills in Scotland (15 inert, 35 non-hazardous and one hazardous).

17.3.11 The 15 operational inert waste landfills had a remaining capacity of 7,894,985 tonnes at the end of 2017.

17.3.12 The remaining capacity of the 35 operational non-hazardous landfills at the end of 2017 was 41,259,961 tonnes.

17.3.13 The only active hazardous landfill site in Scotland in 2017 was Avondale in Falkirk where in 2017 39,876 tonnes was accepted at the site, leaving a remaining capacity of 100,000 tonnes at the end of the year.

Highland, Moray and Aberdeenshire Council Areas

17.3.14 The study area for the proposed scheme includes Highland, Moray and Aberdeenshire Council areas for regional context. In 2017, one operational inert landfill and three operational non-hazardous landfills were recorded in The Highland Council area. There were two operational inert landfills and three operational non-hazardous landfills recorded in Aberdeenshire, and one non-hazardous landfill was recorded in the Moray Council area. Of the 3,826,658 tonnes of controlled waste disposed to landfill in Scotland in 2017 (refer to paragraph 17.3.10), 92,582 tonnes were disposed to landfill in Highland, 289,698 to landfill in Aberdeenshire, and 41,505 tonnes were disposed of to landfill in Moray.

17.3.15 The total quantity of inert waste disposed of to landfill in 2017, and the remaining capacity, for each council area are outlined in Table 17.9.

Table 17.9: Total Used and Remaining Capacity of Operational Landfills (Inert and Non-Hazardous) in Highland, Moray and Aberdeenshire Council Areas) 2017

2017 Capacity (tonnes)	The Highland Council	The Moray Council	Aberdeenshire Council	Total
Inert landfills				
Used	12,400	n/a	14,300	26,700
Remaining	54,500	n/a	2,217,000	2,271,500
Non-hazardous landfills				
Used	80,250	41,500	275,400	397,150
Remaining	734,000	84,000	4,698,900	5,516,900

17.3.16 Table 17.10 provides more details on the sites in Table 17.9, and their location is given in Figure 17.1 (based on information from SEPA's Waste Site and Capacity Tool (SEPA 2019b)).

Table 17.10: Permitted and Remaining Capacity of Operational Landfills (Inert and Non-Hazardous) in Highland and Moray Council Areas (Including Aberdeenshire) 2017

Operational landfills, 2017	Annual Capacity on Permit (tonnes)	Remaining Capacity on 31 December 2017 (tonnes)	Distance and Orientation from Proposed Scheme
Inert landfills			
John Gunn & Sons Limited, Skitten Quarry, Wick	25,000	54,500	Circa 120 to 150km to the north.
Loch Hills Quarry, Parkhill, Dyce, Aberdeenshire	100,000	1,400,000	Circa 120 to 150km to the south-east.
Park Quarry, South Deeside Road, Aberdeen, Aberdeenshire	75,000	817,000	Circa 140 to 170km to the south-east
Non-hazardous landfills			
Granish Landfill Site Cell 3, by Aviemore (for capping/restoration only)	25,000	60,000	Circa 45 to 55km to the south
Seater Landfill Site, Bower, by Wick	65,000	192,000	Circa 130 to 160km to the north
Duisky Landfill Site, Kinlocheil, Fort William	24,000	482,000	Circa 180 to 210km to the south-west
Savoch Landfill, Newton of Savoch, Aberdeenshire	25,000	62,500	Circa 140 to 170km to the east
Stoneyhill Landfill Site, Aberdeenshire	355,000	2,636,400	Circa 140 – 170km to the east
Easter Hatton Farm, Balmedie, Aberdeenshire	190,000	2,000,000	Circa 130 – 160km to the east
Nether Dallachy Landfill Site	120,000	84,000	Circa 50 – 80km to the east
Total Capacity	**1,004,000**	**7,788,400**	

17.4 Potential Impacts

17.4.1 The potential impacts reported in this section are assessed in line with the approach set out in Section 17.2 (Methodology). It is acknowledged that the proposed scheme is within an area where large-scale development is planned, as identified in the local development plan and supplementary guidance. In the future the proposed scheme is anticipated to be located within a landscape which has undergone substantial change; the existing (mainly agricultural) land becoming urbanised as an eastern expansion of the City of Inverness. The potential cumulative impacts in relation to materials and waste of the proposed scheme in-combination with other committed/reasonably foreseeable developments are assessed in Chapter 19 (Assessment of Cumulative Effects).

Material Resources

17.4.2 The types of materials likely to be required for construction are common to all road schemes. Indicative estimated quantities of the major materials required for the proposed scheme including a 10% contingency to cover any unknown items are provided in Table 17.11.

Table 17.11: Summary of Estimated Material Volumes (Including 10% Contingency)

Material	Units	Approximate Estimated Quantity	Worst-Case Scenario Quantity (Including 10% Contingency)	Assumed Indicative Replacement Frequency
Bulk Earthworks (soils and/or rock)*	m^3	327,300	360,030	N/A
Pavement (surfacing, binder and base)**	m^3	13,900	15,290	Surface – 10 years Binder – 20 years Base – 40 years
Sub-base	m^3	23,660	26,025	40 years
Concrete (including culverts)	m^3	5,290	5,820	120 years
Steel	tonnes	810	890	120 years
Drainage Filter Material	m^3	1,130	1,245	10 years
Kerbs	m	17,210	18,930	40 years
Road markings	m	10,720	11,790	10 years
Safety Barriers	m	3,160	3,480	25 years
Boundary Fencing	m	10,640	11,705	25 years
Signs	m^2	410	450	20 years

* This figure includes both imported and site won earthworks.
** Footway quantities are not included in the pavement/sub base materials above.

17.4.3 A proportion of both building materials and composite components used during the construction process would inevitably end up as waste. The Waste and Resources Action Programme (WRAP) has published a Net Waste Tool (WRAP 2008) which projects typical wastage rates in order to assist contractors with construction waste management and minimisation. The Net Waste Tool is not able to forecast waste with complete accuracy; however, it is designed to help project teams identify their major sources of waste, and the most significant opportunities to take action. Wastage rates have been estimated for the proposed scheme and are presented in Table 17.13.

17.4.4 The depletion of finite natural resources could occur through extraction of primary aggregates (e.g. sands and gravels) from regional or other quarries.

17.4.5 Existing on-site soils and materials are considered to be potential material resources, including the following which would be generated during construction of the proposed scheme:

- excavated natural soils and / or rocks (and made ground) produced during topsoil stripping and the construction of cuttings and embankments (collectively referred to as ‘earthworks’). These could be re-used on-site for landscaping or, potentially, for construction projects off-site; and
- road planings, which could be incorporated into new pavements on or off-site.

17.4.6 Although a guiding concept throughout DMRB Stage 3 design has been to seek to achieve a degree of balance between the amount of useable cut material produced from construction and the amount of material required to build embankments and landscaping, this could not be achieved for the proposed scheme. Therefore, the proposed scheme would require additional materials to be imported, to form embankments and landscaping areas. Where possible, consideration has been given to the reuse of existing material. Earthwork volume estimates are provided in Table 17.12.

Aggregates

17.4.7 Imported aggregates are likely to be required for earthworks, structures, drainage and road pavement construction. As set out in Section 17.3 (Baseline Conditions), it is assumed that materials required for the proposed scheme would be sourced from the Inverness region where possible. These can be either primary aggregates, such as sand, natural gravels and rock, or secondary aggregates, such as recycled concrete, recycled road planings, Incinerator Bottom Ash (IBA) aggregate, reclaimed railway ballast and materials from building demolition.

17.4.8 The choice of whether to use primary or secondary aggregates (or a combination of both) would be made considering a combination of factors such as materials source, specification, production and transport. Secondary (recycled) aggregates may not always have the lowest impact on the environment and materials would be selected based on a consideration of all relevant impacts. The procurement process would be implemented through the CEMP and SWMP (**Mitigation Item M-03** and **M-04** respectively) which are further explored in Section 17.7 (Mitigation).

17.4.9 Within the Highland Council and Moray Council areas there is capacity to supply high quality aggregate material as outlined in Section 17.3 (Baseline Conditions). Table 17.7 lists a number of potential quarries in the vicinity of the proposed scheme, and it can reasonably be inferred that there is likely to be an adequate supply of aggregate from regional sources. However, due to European Union competition regulations, it is not possible to prescribe materials sources.

Earthworks

17.4.10 The total volume of bulk earthworks required for the proposed scheme would be approximately 327,300m^3, and the worst-case scenario adding a 10% contingency is 360,030m^3. Cut material (volume from cutting and volume excavated beneath earthworks) is expected to be 112,310m^3 (123,540m^3 including a 10% contingency) and the majority of this is considered to be topsoil. It has been assumed that all cut material excavated would be used (with 70% anticipated to be acceptable and 30% requiring treatment); therefore the export of excess, unusable, materials would not be required, as shown in Table 17.12. The proposed scheme would require additional materials to be imported in addition to any 'site won' material re-used on-site. The estimated earthworks quantities for construction are also provided in Table 17.12; the total estimated import values for earthworks are currently approximately 214,990m^3, and the worst-case scenario adding a 10% contingency is approximately 236,490m^3.

Table 17.12: Earthworks Volume Estimates (Excluding On-site Acceptable Material which does not Require Import or Export)

Earthworks	Approximate Volume (m^3)	Worst-Case Scenario Volume with 10% Contingency (m^3)
Estimated Import	214,990	236,490
Estimated Export	0	0

17.4.11 The design process has sought to identify where specialist materials can be used to reduce the quantities of materials required, for example, the incorporation of geo-textiles in earthworks (i.e. textiles that are permeable to water that can be used for reinforcement) can considerably reduce the quantity of fill material required by improving the strength of the structure.

Waste

Construction, Demolition and Excavation (CD&E) Waste

17.4.12 The production, storage and re-use of waste on site during construction are likely to have short-term temporary impacts. Most of the waste generated from the proposed scheme would be CD&E waste. WRAP identifies CD&E wastes as waste materials arising from UK commercial CD&E sites. It includes, but is not limited to, off-cuts and waste timber, plastics (such as uPVC & HDPE), glass (such as windows), packaging (for example card, wood and plastic film), and inert materials such as soils and rubble. It also includes aggregate materials (such as masonry, brick and block, paving, tiles and ceramics) and plasterboard in mixed waste.

17.4.13 The WRAP Net Waste Tool has been applied to the worst-case scenario materials volumes (with a 10% contingency) estimated for the proposed scheme. Wastage rates in the WRAP Net Waste Tool exist in two forms, baseline and good practice, the latter being associated with Modern Methods of Construction (MMC). As MMC would be used in the construction of the proposed scheme, the good practice wastage rates have been applied to the estimated materials volumes. The estimated waste arisings are presented in Table 17.13.

Table 17.13: Summary of Estimated Waste Arisings from Material Usage (Including 10% Contingency)

Material	Units	Worst-Case Scenario Quantity (Including 10% Contingency)	'Good' Wastage Rate (WRAP)	Estimated Waste Arisings
Pavement (surfacing, binder and base)	m^3	15,290	5.00%	765
Sub-base	m^3	26,025	2.50%	650
Concrete (including culverts)	m^3	5,820	5.00%	290
Steel	Tonnes	890	5.00%	45
Drainage Filter Material	m^3	1,245	2.50%	30
Kerbs	m^3	18,930	0%	0
Road markings	m^3	11,790	5.00%	590
Safety Barriers	m^3	3,480	5.00%	175
Boundary Fencing	m^3	11,705	0%	0
Signs*	m^2	450	0%	0

17.4.14 For wastes and surplus or defective materials, impacts are primarily associated with the production, movement, transport and processing (including recycling/recovery) of the wastes on and off-site, and, if required, their disposal at permitted off-site facilities. Based on the waste capacity outlined in Section 17.3 (Baseline Conditions) at the end of 2017 there was operational landfill capacity of 7,788,400 tonnes remaining within The Highland Council, Moray and Aberdeenshire Council areas. Waste management would become a concern of high importance if there was a risk of using up capacity at waste management facilities, thereby forcing locally-produced wastes to be transported greater distances for disposal elsewhere.

Demolition Wastes

17.4.15 No structures would need to be demolished for construction of the proposed scheme.

Earthworks

17.4.16 Estimated quantities have been calculated for pavement, sub-base, top-soils and earthworks materials that are likely to require re-use / export off-site. No waste arisings are forecast in relation to top soils and earthworks. Table 17.13, however, indicates that approximately ~1,415m^3 of waste is expected to arise from pavement and sub-base in a worst-case scenario (with a 10% contingency). The University of Bath Inventory of Carbon and Energy (2011) provides a conversion factor of 2.24 to calculate tonnes per cubic metre for mixed CD&E waste, which would equate to approximately 3,170 tonnes.

17.4.17 In accordance with Scotland's Zero Waste Plan (2010) wastes would be re-used or recycled off-site where possible. It is likely that a proportion of the materials imported would be secondary (recovered / recycled materials) and that materials exported off-site could potentially be used on other construction sites or elsewhere, for example opportunities may exist for peat to be re-used in the restoration of worked out quarries and closed landfills. Mixing imported and existing in-situ materials with recycled content may divert other third party wastes away from landfills, thereby minimising the volume of waste disposed to landfill overall.

Other Wastes

17.4.18 Other wastes may include:

- surplus organic materials including vegetation from shrub or tree clearance;
- hazardous / special wastes including contaminated soil (likely to be of minimal volume);
- municipal solid waste (MSW) from construction workers (likely to be of minimal volume); and
- surplus materials (likely to be of minimal volume).

17.4.19 With regards to the items listed above, quantities for specific items cannot be estimated at this time. This information would become available at the detailed design stage but they are discussed briefly below.

Vegetation Clearance

17.4.20 Surplus organic materials, including vegetation from shrub, tree or garden clearance or deposits removed from within redundant drainage channels, could generate waste material for disposal.

17.4.21 Approximately 1.46 hectares (ha) of woodland is required to be cleared for the proposed scheme. Where suitable, such waste would be re-used or recycled (under appropriate licences, as required), such as through on-site landscaping or ecological improvement works. It is anticipated that the majority of woodland vegetation, however, would be chipped on-site and removed for composting to a suitably permitted waste management facility.

Hazardous/Special Wastes

17.4.22 Hazardous/special wastes may comprise any contaminated soils that cannot be treated to make them suitable for use, such as any material contaminated with asbestos or Volatile Organic Compounds (VOC) oils, metals etc. Disturbance or storage of contaminated soils during construction can also lead to the release of chemical pollutants into the air, ground or water (remobilisation of contaminants).

17.4.23 The potential for waste materials or land uses to generate contaminated soils or groundwater, and the means by which any such waste would be managed, is discussed in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater). It is not anticipated that asbestos would be encountered during the construction of the proposed scheme.

Municipal Solid Wastes

17.4.24 Accommodation units for construction workers would generate general municipal wastes in small volumes. Again, there is adequate capacity for the disposal of such wastes, please see Section 17.3 (Baseline Conditions). Segregation facilities would be provided on the construction site to ensure that recovery and recycling of such wastes is maximised.

Surplus Materials

17.4.25 Surplus materials would be avoided wherever possible by efficient quantity surveying and procurement. Although it is difficult to estimate quantities at this stage, it should be noted that it is in the interest of the appointed contractor to keep surplus materials to a minimum. Further information would be made available within the appointed contractor's SWMP, but storage facilities for bulk materials are likely to include the use of silos, hoppers, tanks or bins, if any surplus materials do

arise they would be segregated and returned to the manufacturer where possible.

Other Relevant Assessments

17.4.26 In regard to construction impacts Chapter 7 (Air Quality) concludes that with the implementation of appropriate dust management measures there would not be any residual effects on air quality during the construction phase. It is assumed in Chapter 8 (Noise and Vibration) that should the recommended mitigation measures be adopted, any potential adverse impacts associated with the construction may not arise and any that do would be short-term in nature. The implementation of mitigation measures in relation to contaminated land issues is expected to reduce the potential impacts of the proposed scheme to a residual impact of Low significance during the construction phase as detailed in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater).

17.5 Carbon Assessment

17.5.1 A detailed assessment of the potential CO_2e impacts of the proposed scheme has been carried out (based on the indicative material and waste volumes from the DMRB Stage 3 design, including a 10% contingency to present a worst-case scenario) using Transport Scotland's Project Carbon Tool. This tool was developed to measure carbon emissions associated with construction and maintenance activities of road and rail schemes, and it allows users to estimate whole life carbon emissions for projects based on the embodied carbon associated with material use, transport of materials and waste, site plant energy consumption and energy consumption during operation as well as emissions associated with structural maintenance. The full report is included in Appendix A17.2 (Carbon Assessment).

17.5.2 Design information incorporated into the carbon assessment included:

- information on earthworks required in the project;
- detailed pavement specifications for the different sections of the project;
- structures such as bridges, culverts and underpasses;
- drainage filter material;
- kerbs;
- safety barriers;
- boundary fencing; and
- signage.

17.5.3 This information allowed for the calculation of material use, which is presented in Tables 17.14 and 17.15 by broad material type and construction components.

Table 17.14: Summary by Project Elements (worst-case scenario including a 10% contingency)

Project elements	Materials embodied (tCO_2e)	Maintenance (materials embodied) (tCO_2e)
Drainage	60	615
Earthworks	8,290	0
Fencing	120	470
Road Pavement	3,085	12,230
Safety Barriers	125	490
Signs	35	165
Structures (civils & buildings)	3,345	0

Table 17.15: Summary by Material Types: Construction Embodied Only (worst-case scenario including 10% Contingency)

Material types	tCO_2e
Aggregate	685
Aluminium	35
Asphalt and bitumen	2,180
Concrete, cement, and cement substitutes (including steel reinforcement)	2,280
Iron and steel	1,485
Paint and coating	15
Plastic	20
Soil	8,285

17.5.4 The source data was inputted into the Projects Carbon Tool, taking account of the assumptions and exclusions outlined in Appendix A17.2 (Carbon Assessment), in order to estimate the carbon emissions in tonnes of carbon dioxide equivalent (tCO_2e) associated with the proposed scheme. The results are set out in Table 17.16. It should be noted that that due to rounding of data outputs there are slight discrepancies between the totals presented in Tables 17.14 and 17.15, when compared to Table 17.16. It is confirmed that the information provided in these tables is correct as an output of the Projects Carbon Tool.

Table 17.16: Project Emissions Summary

Carbon source	Worst-Case Scenario tCO_2e (Including 10% Contingency)
Construction: Materials embodied	15,050
Maintenance: Materials embodied	13,975

17.5.5 Carbon emissions related to construction materials are anticipated to be approximately 15,050tCO_2e, including a 10% contingency, whilst it is anticipated that the materials used for maintenance would produce carbon emissions of approximately 13,975tCO_2e resulting in a minor magnitude of impact for both phases. The operational emissions have been calculated on the assumption that the proposed scheme would be operational for 100 years.

17.6 Impact Summary and Magnitude / Significance Evaluation

17.6.1 The impacts identified for both materials and waste, and their magnitude/significance are summarised in the Detailed Assessment Reporting Matrix in Table 17.17.

Table 17.17: Detailed Assessment Reporting Matrix

Project Activity	Potential Impacts associated with Material Resource Use / Waste Management	Description of the Impacts (all impacts are considered to be adverse unless otherwise stated)
Site Remediation / Preparation	Disposal of wastes and soils unsuitable for use on-site	Assumes that the proposed scheme would generate no demolition waste, and all excavated soils are expected to be re-used on site: • Description of impact: **Adverse, Direct, Temporary, Cumulative** • Sensitivity of the receptor: **Low** • Magnitude of impact: **Negligible** • Significance of effect: **Neutral** • Significant for the purposes of EIA: **No**
	Disposal of excavation wastes	Assumes that the proposed scheme would generate approximately 3,170 tonnes of waste from pavement and sub-base which would be predominantly segregated and sent for recycling or further segregation at a materials recovery facility: • Description of impact: **Adverse, Direct, Temporary, Cumulative** • Sensitivity of the receptor: **Low** • Magnitude of impact: **Minor** • Significance of effect: **Neutral/Slight** • Significant for the purposes of EIA: **No**
	Production of hazardous wastes (e.g. contaminated soils)	Assumes that no or low volumes of contaminated soils are expected. Transport for disposal 250km away in Falkirk: • Description of impact: **Adverse, Direct, Temporary, Cumulative** • Sensitivity of the receptor: **Low** • Magnitude of impact: **Major** • Significance of effect: **Slight/Moderate** (if realised). • Significant for the purposes of EIA: **No**
Construction	Material use and depletion (e.g. virgin aggregates)	Assumes that there is likely to be an adequate supply of aggregate from regional quarry sources: • Description of impact: **Adverse, Direct, Permanent, Cumulative** • Sensitivity of the receptor: **Low** • Magnitude of impact: **Minor** • Significance of effect: **Neutral/Slight** • Significant for the purposes of EIA: **No**
	Embodied Carbon Emissions	Assumes that the proposed scheme would generate approximately 15,050tCO_2e of embodied carbon emission from its use of construction materials and products: • Description of impact: **Adverse, Indirect, Permanent, Cumulative** • Sensitivity of the receptor: **Not applicable** • Magnitude of impact: **Minor** • Significance of effect: **Not applicable** • Significant for the purposes of EIA: **Not applicable**
	Disposal of surplus construction materials and waste	Assumes that soils waste would be re-used on site, and any residual construction waste would be predominantly segregated and sent for recycling or further segregation at a materials recovery facility: • Description of impact: **Adverse, Direct, Temporary, Cumulative** • Sensitivity of the receptor: **Medium**

Project Activity	Potential Impacts associated with Material Resource Use / Waste Management	Description of the Impacts (all impacts are considered to be adverse unless otherwise stated)
		• Magnitude of impact: **Minor** • Significance of effect: **Slight** • Significant for the purposes of EIA: **No**
Operation	Embodied Carbon Emissions of Replacement Materials	Assumes that the proposed scheme would generate approximately 13,975tCO_2e of embodied carbon emission from its use of replacement materials: • Description of impact: **Adverse, Indirect, Permanent, Cumulative** • Sensitivity of the receptor: **Not applicable** • Magnitude of impact: **Minor** • Significance of effect: **Not applicable** • Significant for the purposes of EIA: **Not applicable**

17.7 Mitigation

General

17.7.1 Mitigation measures for the proposed scheme in relation to the materials and wastes are detailed below and take into account best practice, legislation, guidance and professional experience. The mitigation commitments identified in the Strategic Environmental Assessment (SEA) for the Strategic Transport Projects Review (STPR) (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2014 and 2015) have also been taken into consideration, along with the mitigation measures outlined in the A96 Dualling Inverness to Nairn (including Nairn Bypass) DMRB Stage 3: Environmental Impact Assessment - Environmental Statement (Jacobs 2017).

17.7.2 There is significant synergy between materials re-use and the avoidance of the generation of waste and a substantial overlap between the mitigation measures for materials and waste. Measures will be implemented to minimise both the use of materials and the generation of waste in relation to the proposed scheme.

17.7.3 The importance of careful management of materials to promote re-use and reduce waste has been widely recognised by the construction industry. Both legislation and voluntary best practice mechanisms have been developed and implemented. These provide measurable and accountable processes that form the basis for mitigating adverse environmental impacts associated with materials and waste.

17.7.4 Structures, drainage, road restraint systems, street lighting, traffic signals and signage products are to be procured for the proposed scheme with consideration of the environmental impacts associated with their manufacture, as well as other considerations such as structural design, carbon footprint, energy consumption, long-life performance, visual impacts, durability and cost.

17.7.5 Both reinforced concrete and steel structures include a measurable recycled content in their manufacture. Where possible, the availability of responsibly sourced local and recycled materials should be considered in order to reduce potential environmental effects, such as from transport emissions.

17.7.6 The principles of the waste hierarchy (Diagram 17.1) will be applied to minimise waste generation and maximise re-use of materials on-site, where possible. Where re-use is not possible within the proposed scheme, alternative options would be sought off-site.

Mitigation Item M-01: Application of Waste Hierarchy

17.7.7 The contractor will apply the principles of the waste hierarchy to the management of waste and materials during the construction phase. This will include, but not limited to, the following:

- where possible, any site won materials will be re-used within the proposed scheme;
- where materials generated during construction cannot be used for the proposed scheme, opportunities will be sought to re-use the materials on other local projects. It may be possible to recycle all, or most, of the road surface (planings) for incorporation in other schemes or for sale to other local construction projects;
- where suitable, green waste will be re-used or recycled, such as through on-site landscaping or ecological improvement works; for example, for habitat creation, or spread as chippings or mulch, with appropriate consideration and control of any watercourse pollution risk and required waste management licences. Off-site disposal through a green waste disposal contractor could also offer recycling through composting (note: there are five sites with operational composting capacity in the Highland and Moray Council areas); and
- the use of, for example, geotextiles to considerably reduce the quantity of fill material required by improving the strength of structures will be investigated by the contractor.

Mitigation Item M-02: Compliance with Relevant Waste Legislation

17.7.8 For all potential waste arisings, the contractor would be required to comply with The Waste Management Licensing (Scotland) Regulations 2011 (WML).

17.7.9 Consideration will also be given to SEPA guidance on sustainable waste management, such as the 'Regulatory Guidance: Promoting the Sustainable Re-use of Greenfield Soils in Construction' (March 2010), 'Guidance on the Production of Fully Recovered Asphalt Road Planings' and appropriate SEPA Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs). SEPA is currently carrying out a review of environmental regulatory guidance for Scotland, replacing PPGs with a new guidance series called GPPs; however, both systems continue to provide environmental good practice guidance. If necessary, the contractor will consult SEPA for advice. If wastes could not be legitimately re-used on site, they will be removed to a permitted recycling or disposal facility in line with regulatory requirements.

17.7.10 In addition, Zero Waste Scotland Designing out Waste Guide for Civil Engineering (WRAP 2016); and Transport Scotland's CMS Road Infrastructure Projects Tool to support low-carbon decision-making during specimen design, detailed design and construction, will be utilised by the contractor (in accordance with Transport Scotland's Corporate Plan). This will be referenced in the SWMP.

Mitigation Item M-03: Implementation of a Construction Environmental Management Plan (CEMP)

17.7.11 The CEMP (refer to **Mitigation Item SM-01**) will be developed by the appointed contractor during the detailed design phase (i.e. before the start of construction works) and implemented in advance of the construction phase. The CEMP would include the following in relation to the management of materials and waste:

- Details of the approach to environmental management throughout the construction phase, with the primary aim of mitigating any adverse impacts from construction activity on identified sensitive receptors.
- Procurement and waste management protocols / KPIs and targets designed to minimise impacts on the environment and maximise local procurement of materials and waste management options.
- Good materials management methods, such as co-location of temporary haul routes on permanent capping and recovery and re-use of temporary works materials from haul routes, plant and piling mattresses, as well as use of 'just-in-time' delivery to minimise double handling.
- In order to minimise effects on amenity, materials for import and waste disposal would be transported appropriately along prescribed routes which are likely to include the A9 Perth – Inverness Trunk Road () and A96 Aberdeen – Inverness Trunk Road (which incorporates the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme proposals). Prescribed routes would be included in the main construction contract documents. The contractor would be required to seek approval from the relevant authority should they wish to use any other routes.
- Risk / impact-specific method statements and strategic details of how relevant environmental impacts would be addressed throughout the proposed scheme, embodying the requirements of the relevant SEPA PPGs/GPPs.

Mitigation Item M-04: Implementation of a Site Waste Management Plan (SWMP)

17.7.12 Though not mandatory in Scotland, a SWMP will be developed, either as part of the CEMP or as a separate document and would be regularly updated. The SWMP will identify, prior to the start of construction works, the types and likely quantities of wastes that may be generated. It will set out, in an auditable manner, how waste will be reduced, re-used, managed and disposed of in accordance with WRAP guidance. The SWMP is a 'live' document and would be developed by the contractor before commencement of the construction phase and would include waste minimisation targets and associated KPIs. It will be written in accordance with Zero Waste Scotland and WRAP guidance.

17.7.13 If required, a Materials Management Plan (MMP) will set out how all construction phase materials will be managed, including specific soils management plans developed under the following voluntary and industry regulated Codes of Practice such as:

- Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2009) provides practice guidance for the excavation, handling, storage and final placement of soils.
- Land Remediation and Waste Management Guidelines (SEPA 2009) provides a process whereby contaminated soils can be re-used on the site of origin (i.e. they do not become a waste) if they are proven, through appropriate risk assessments, to be suitable for use. It also provides for soils with naturally elevated contamination levels to be used directly on another site provided that they are suitable for use at that site.

17.7.14 Implementation of the SWMP will minimise waste at source, during detailed design and construction, by facilitating measures to maximise re-use of materials on-site and reduce the need for new construction materials. Regular reviews of, and updates to, the SWMP will enable the monitoring of the effectiveness of the mitigation measures at minimising waste generation, especially disposal to landfill.

Mitigation Item M-05: Hazardous Wastes

17.7.15 If contaminated soils are encountered during the construction works, further investigation, testing and risk assessment will be undertaken to determine whether the soils could stay on-site, will require treatment to make them suitable to remain on-site, or require to be disposed of off-site. Details for dealing with unexpected contaminated soils have been provided in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater).

Mitigation Item M-06: Carbon Saving Measures

17.7.16 Carbon quantification is vital for ensuring an understanding of the greatest carbon impacts for the proposed scheme, enabling opportunities for reducing carbon to be highlighted.

17.7.17 Reporting and guidance, such as the Infrastructure Carbon Review (HM Treasury 2013) and Building a Sustainable Future (Institution of Civil Engineers (ICE) 2011) indicate that the potential to influence carbon emissions decreases as a project progresses, from the most during the planning stage, to more modest reductions during design and construction.

17.7.18 With this in mind, the key early intervention procedure, as identified in the Infrastructure Carbon Review, can be considered to be:

- avoid and/or eliminate or ‘build nothing’: challenge the need; explore alternative approaches to achieve the desired outcome;
- reduce or ‘build less’: maximise the use of existing assets, optimise asset operation and management to reduce the extent of new construction required;
- substitute or replace or ‘build clever’: design in the use of low carbon materials, streamline the delivery process, minimise resource consumption; and
- compensate or ‘build efficiently’: embrace new construction technologies, eliminate waste.

17.7.19 Use of significant quantities of high impact materials, (e.g. steel and aluminium), or processes (e.g. large amounts of excavation), should be avoided where practicable through alternative design specification. If this cannot be done, the amount of material or the length/intensity of the process should be reduced where functional specifications allow. Materials or processes should be substituted with lower intensity replacements, if possible within design standards for strength and safety. Finally, compensatory measures, such as carbon offsetting, should be considered where it is felt they would be cost effective.

17.7.20 Where it would not significantly impact upon engineering, safety and maintenance characteristics, the principle of substitution requires that low carbon alternatives for materials be considered.

17.7.21 Imported soil is a significant part of the overall carbon footprint of this proposed scheme. Opportunities to obtain additional soil fill on-site should be maximised and, where it would not significantly alter the safety and driving characteristics of the road, soil fill should be reduced.

17.7.22 The regular maintenance of the road pavement, including the surface course, sub-base and base course contributes a significant proportion of the calculated whole-life emissions, making up approximately 48% of the whole. Investigation of either a more hard-wearing material for the surface course or a material with a lower emissions factor should be a priority for any mitigation measures.

Mitigation Summary

17.7.23 Table 17.18 summarises measures that would be adopted in accordance with Annex 4 of the draft HD 212/11 guidance.

Table 17.18: Mitigation Measures Reporting Matrix

Project Activity	Potential Impacts associated with Material Resource Use / Waste Management	Description of the Key Mitigation Measures	Mitigation Reference	How the Measures would be Implemented, Measured, and Monitored
Site Remediation / Preparation	Disposal of wastes and soils unsuitable for use on-site	SWMP including use of targets as Key Performance Indicators (KPIs). Market testing for the use of wastes off-site via the materials exchange.	**M-01, M-02, M-03, M-04**	Implemented by contractor. Use of weighbridge records and waste transfer notes. Audited regularly by Environmental Coordinator / Clerk of Works.
	Disposal of excavation wastes	SWMP and KPIs.	**M-01, M-02, M-03, M-04**	Implemented by contractor. Incorporation of on-site recovered materials in detailed design. Audited regularly by Environmental Coordinator / Clerk of Works.
	Production of hazardous wastes (e.g. contaminated soils)	SWMP. On-site or off-site treatment of contaminated soils for any hazardous wastes identified on-site, as appropriate.	**M-01, M-02, M-03, M-04, M-05**	Implemented by contractor. Use of weighbridge records and hazardous waste transfer notes. Audited regularly by Environmental Coordinator / Clerk of Works.
Construction	Material use and depletion (e.g. virgin aggregates)	CEMP. Use of procurement policies, targets and KPIs to maximise local sourcing of materials and the inclusion of as much recycled content as practicable in accordance with the required specifications of the construction material.	**M-01, M-02, M-03, M-04**	Procurement policies to be implemented by the contractor. Measured via weighbridge records and receipts and analysis of procurement criteria used for specific materials. Audited regularly by Environmental Coordinator / Clerk of Works.
	Embodied Carbon Emissions	As above.	**M-01, M-02, M-03, M-04, M-06**	As above. Procurement policies to include whole life CO_2e emissions data as a KPI for all materials.
	Disposal of surplus construction materials and waste	SWMP and KPIs. Provision of segregation facilities.	**M-01, M-02, M-03, M-04**	Implemented by contractor. Use of weighbridge records and waste transfer notes. Audited regularly by Environmental Coordinator / Clerk of Works.
Operation	Embodied Carbon Emissions of Replacement Materials	Use of procurement policies to maximise local sourcing of materials and the inclusion of as much recycled content as practicable during operation.	**M-06**	Ongoing procurement policies to include whole life CO_2e emissions data as a KPI for all maintenance materials.

17.8 Residual Impacts

17.8.1 A high proportion of the potential residual impacts associated with materials cannot be absolutely predicted, as many would only occur if something unexpected were to happen (i.e. they would be the result of unplanned, accidental occurrences, such as spillages, or as a result of failure by a contractor or sub-contractor to follow procedures established in the various management plans described in this chapter).

17.8.2 The significance of the majority of waste impacts described in this chapter is expected to be Slight or Neutral as illustrated in Table 17.17. These risks can be reduced or eliminated through well-planned and well-controlled construction site management, planned and expressed through procedures included in the CEMP and SWMP. With the proper application of these management procedures, it is expected that the significance of waste impacts can be further reduced.

17.8.3 Should contaminated soils be encountered during construction, this could result in a Slight/Moderate adverse impact; however, with appropriate mitigation (as detailed in Chapter 12: Geology, Soils, Contaminated Land and Groundwater) this is expected to be reduced through reuse or treatment where appropriate.

17.8.4 The magnitude of the proposed scheme's carbon emissions during both the construction and operation phases would be Minor as set out in Table 17.1 (Materials (Carbon) Assessment Magnitude Criteria). If carbon efficient procurement can be maximised during construction and operation, then there is the potential to further reduce these impacts.

17.8.5 It should be noted that at all stages of the project the appointed contractor would aim to minimise waste, re-use as much material as possible on-site, recycle/recover as much waste that cannot be used on site as possible and minimise carbon emissions. Thus, the proposals would accord with relevant legislation, policy and guidance as set out in this chapter.

17.9 Statement of Significance

17.9.1 All impacts on materials and waste are not predicted to be significant in the context of the EIA Regulations.

17.10 References

Reports and Documents

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EU Directives and Legislation

European Commission (2006). Waste Framework Directive (European Directive 2006/12/EC, as amended by Directive (2008/98/EC)

The Waste Management Licensing (Scotland) Regulations 2011