17 Materials

This chapter presents the results of the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) for the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme (hereafter referred to as the proposed Scheme). This is an assessment of the potential impacts of the proposed Scheme 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.

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 will be reduced. In particular, this will be achieved by re-using existing soils and redundant or demolition material where possible, taking into consideration the environmental impacts of products during their purchase, and sourcing materials from local suppliers.

The potential for impacts on materials or waste disposal facilities is related to the performance of the appointed 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 application of these plans and the proposed mitigation measures, the significance of impacts affecting material resources and waste is considered to be reduced to Slight or Neutral. The magnitude of the proposed Scheme's carbon emissions during construction and operation will be Major.

17.1 Introduction

17.1.1 This chapter presents the results of the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) for the A96 Dualling Inverness to Nairn (including Nairn Bypass) 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 Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6 HD212/11 Materials Chapter, amended as per conventions (The Highways Agency (now Highways England) et al, 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 continues to outline that manufactured construction products can include the construction of road surfacing, bridges, gantries, signage, barriers, lighting and fencing. It also recognises that 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. It is noted that 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) (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 Statement (ES). 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 located in Volume 2: Technical Appendices of this Environmental Statement, and cross referenced where relevant:

- Appendix A17.1 (Key Materials and 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. In particular, 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 sourcing materials from local suppliers. 'Whole life' carbon emissions associated with construction and maintenance of the proposed Scheme have also been assessed in Section 17.6 (Carbon Assessment).

17.1.10 The potential for residual impacts on material resources or waste disposal facilities is principally related to the performance of the appointed 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) see Section 17.8 (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 is with soils and geology (Chapter 12: Geology, Soils, Contaminated Land and Groundwater), given the understanding required regarding the nature of the materials. There are also inter-relationships with dust (Chapter 7: Air Quality), noise resulting from traffic movement associated with demolition activities, the collection and removal of waste, and the supply of materials (Chapter 8: Noise and Vibration).

17.1.12 The use of materials and the production of waste can affect the full range of environmental aspects. Effects on the wider environment have been assessed within each of the other technical chapters in the ES, 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 (Chapter 12: Geology, Soils, Contaminated Land and Groundwater).

- Surface water environment. There are a number of sensitive environments in the vicinity of, or located along, the proposed Scheme, including Cairnlaw Burn, Rough Burn, Balnagowan Burn, River Nairn and Auldearn Burn, For baseline information refer to Chapters 13 (Road Drainage and the Water Environment) and Chapter 11 (Habitats and Biodiversity).
- Humans, particularly local residents, and commercial businesses (Chapter 7: Air Quality, Chapter 8: Noise and Vibration, and Chapter 15: People and Communities: Community and Private Assets).
- Wildlife and habitats. Information on habitats and protected species is provided in Chapter 11 (Habitats and Biodiversity) and associated appendices and figures.
- Global climate and emissions, through the use of energy and resultant greenhouse gas emissions (Chapter 7: Air Quality).

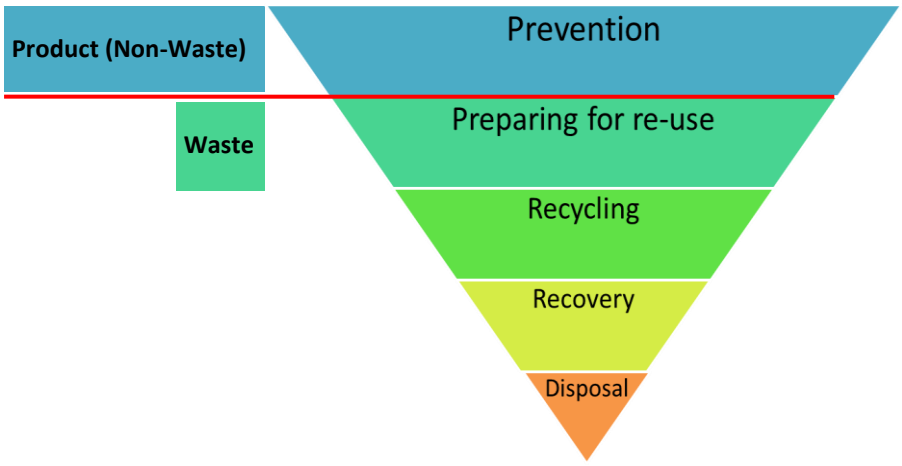
17.2 Legislative and Policy Background

17.2.1 Draft HD212/11 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*'.

17.2.2 Waste management is structured around a 'waste hierarchy' which defines the order of preference of the various waste management options. Diagram 17.1 below illustrates the waste hierarchy as per Directive 2008/98/EC.

Diagram 17.1: The Waste Hierarchy



17.2.3 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).

17.2.4 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.

Key Legislation, Plans, Policies and Guidance

17.2.5 Appendix A18.1 (Planning Policy Context for Environmental Assessment) describes the planning policies and guidance from national to local level which are relevant to the Materials Assessment. An assessment of the compliance of the proposed Scheme against all development plan policies

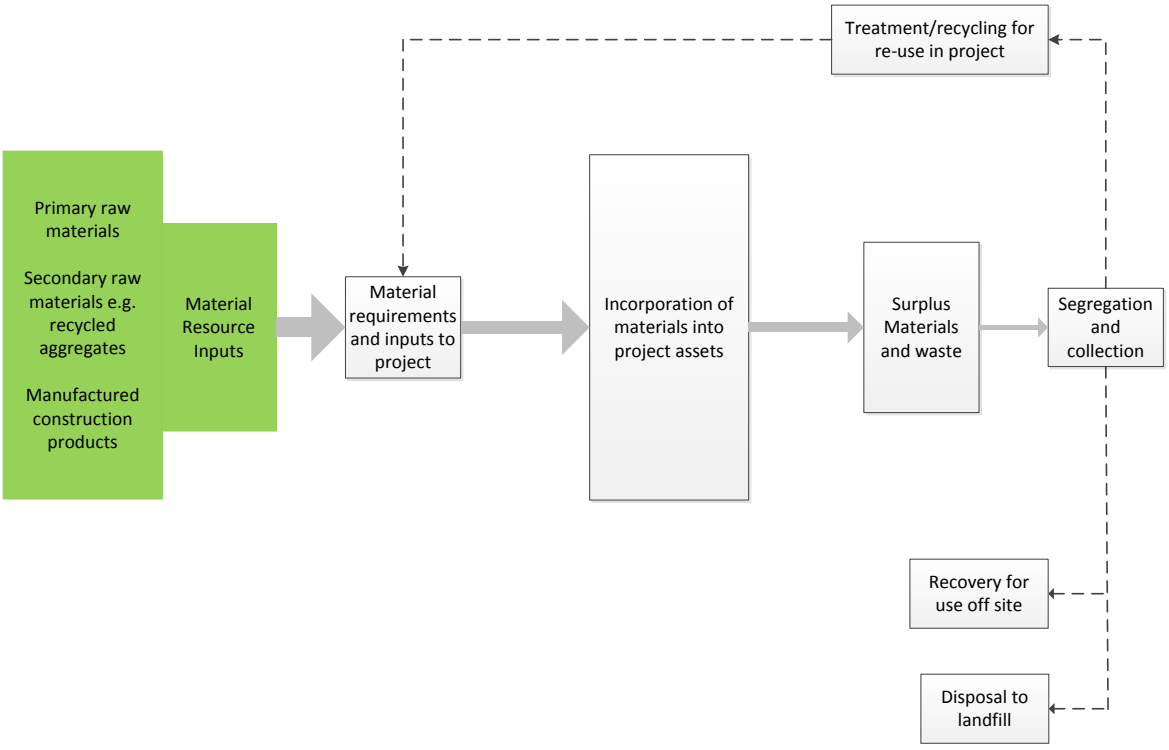
relevant to this environmental topic is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) and a summary overview is provided in Section 18.4 (Assessment of Compliance) in Chapter 18 (Policies and Plans). Appendix A17.1 (Key Materials and Waste Legislation) provides more detail on a list of relevant legislation, plans and guidance as they relate to this materials assessment.

17.3 Methodology

Approach to the Assessment

17.3.1 Environmental impacts associated with material resources and wastes occur at each stage of the projects material flow cycle. Draft HD212/11 does not include a specific material's resource flow diagram, however the now superseded IAN 153/11 (Highways Agency 2011) provides a useful diagram (recreated below in Diagram 17.2). This presents a simplified materials resource flow and is still relevant for the purposes of this assessment.

Diagram 17.2: A Project's Material Flow Cycle (recreated from IAN153/11 (Highways Agency 2011))



17.3.2 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.

17.3.3 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. 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;
- 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.

17.3.4 Operational impacts of the proposed Scheme 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.

17.3.5 It is difficult to quantify the potential impacts of material usage and waste production during the operational phase of the proposed Scheme, however these impacts would be mitigated by the continued application of the waste hierarchy principals in regard to any future maintenance, and by adequate upkeep of the proposed Scheme in terms of regular road sweeping and collection of any debris by the appointed maintenance contractor. It should be noted that there is already a maintenance regime in place for the existing A96 carriageways.

17.3.6 Draft HD212/11 states that ongoing operational and maintenance impacts should be considered, and that an assessment of the potential carbon dioxide equivalent (CO_2e) impacts of the proposed Scheme should be undertaken at this stage, 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 2014). 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 17.6 (Carbon Assessment).

Study Area

17.3.7 The study area for this chapter has two boundaries. The first boundary encompasses The Highland Council (THC) area in terms of the locations of source materials and waste management infrastructure (although the neighbouring Moray Council area and Aberdeenshire is also discussed where considered appropriate). The second is limited to the proposed Scheme boundaries within which materials would be used and wastes generated and managed. Chapter 4 (The Proposed Scheme) provides a detailed description of the proposed Scheme. The proposed Scheme boundary is defined as including the full footprint of the proposed Scheme, as defined in the draft Orders for the proposed Scheme. Identification of existing baseline waste management infrastructure, and raw material reserves / availability has been carried out to inform the assessment of the proposed Scheme according to conditions likely to be present at the commencement of construction (the opening year of the proposed Scheme is assumed for the purposes of this assessment to be 2021).

Impact Assessment

17.3.8 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 has included a 10% contingency of material 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, re-use, recycling and recovery);
- types, locations and capacities of identified waste management facilities (incl. disposal sites); and
- types, quantities and classification of waste forecast to be produced at each phase of the project, including disposal routes.

17.3.9 Impacts can be adverse, beneficial; direct, indirect; short-term, medium-term or long-term; temporary or permanent, and cumulative.

Assessment Criteria

17.3.10 Sensitivity, magnitude and significance criteria have been derived from guidance in draft HD212/11 following the 'detailed assessment reporting matrix', and are described below.

Materials

17.3.11 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 of the proposed Scheme using the Transport Scotland CMS. Levels of magnitude are defined as follows from Table 4.4 of draft HD212/11, 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 – 5,000
Minor	5,000 – 20,000
Moderate	20,000 – 40,000
Major	>40,000

17.3.12 The methodology in draft HD212/11 guidance does not include sensitivity criteria for materials use, which would need to be accounted for in order to derive the significance of any impact. For the purposes of this assessment however 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.

17.3.13 Although we have assigned a measure of sensitivity to the supply of materials from the local area for the purposes of this assessment, a matrix does not exist within the current guidance that allows us to combine the sensitivity and magnitude criteria to determine significance of the impact.

Waste

17.3.14 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 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.

17.3.15 Draft HD212/11 determines sensitivity on the basis of capacity as outlined in Table 17.2 below.

Table 17.2: 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.

17.3.16 Magnitude is defined as per draft HD212/11 in Table 17.3 below.

Table 17.3: 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 to 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.

17.3.17 Significance is derived by combining sensitivity and magnitude as set out in Table 17.4 below (based on Table 4.5 of draft HD212/11).

Table 17.4: Waste Assessment Significance Criteria

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

Mitigation

17.3.18 Potential mitigation measures have been considered during this assessment and take into account best practice, legislation, guidance and professional experience.

17.3.19 As described in Chapter 1 (Introduction) and Chapter 5 (Overview of the Assessment Process) the mitigation commitments and monitoring frameworks identified in the Strategic Environmental Assessments (SEAs) for the Strategic Transport Projects Review (STPR) (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration in relation to the mitigation proposals.

17.3.20 The mitigation commitment relevant to the Materials Assessment detailed within the STPR SEA is detailed below:

'*Fully consider the use of secondary or recycled aggregates in the construction of interventions. There are no construction and demolition recycling targets detailed in the Scottish National Waste Strategy, however in England the Government (DEFRA[1]) is considering a target to halve the amount of construction, demolition and excavation waste going to landfill by 2012, as a result of waste reduction, reuse and recycling. Scotland could also introduce a similar target*.'

17.3.21 No specific mitigation commitments for the Materials Assessment were detailed within the A96 Dualling Programme SEA Post Adoption Statement; however there was an objective to reduce the environmental effects on the communities in the corridor. SEPA further recommended in the SEA Post Adoption Statement that all relevant legislation be considered in the assessment, including Local Development Plans (LDPs), Scottish Planning Policy (SPP), and the Waste Management Licensing (Scotland) Regulations (2011). Where avoidance of forestry is not possible, consideration must be given to management of forestry waste and appropriate guidance followed.

17.3.22 The specific mitigation measures in relation to the proposed Scheme are discussed further in Section 17.8 (Mitigation).

Limitations of the Assessment

17.3.23 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 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.

17.3.24 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. 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 (termed 'cradle to grave') as a proxy for the 'overall' scale of impacts associated with raw material extraction and use.

17.3.25 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.

17.4 Baseline Description and Evaluation

Project Objectives

17.4.1 The STPR SEA has developed a series of strategic environmental assessment objectives for the STPR which includes the following relevant to this Materials Assessment:

[1] DEFRA (2007) E-Digest Statistics – Waste and Recycling

- '*Make prudent use of natural resources such as minerals and aggregates in the improvement of transport infrastructure*'; and
- '*Minimise waste by re-using and recycling materials where possible in the construction of transport infrastructure*'.

17.4.2 The STPR SEA also presents the findings of a bespoke sustainability appraisal on the STPR Key Strategic Outcomes (KSOs) to illustrate how these conform to overall Scottish sustainability aspirations**:**

- KSO1: Improved Journey Times & Connections;
- KSO2: Reduced Emissions; and
- KSO3: Improve Quality, Accessibility and Affordability.

17.4.3 **KSO2: Reduced Emissions** sets out to tackle the issues of climate change, air quality and health improvement. Recognising the challenges of reducing emissions, the overall objectives for the transport network is to adopt a stepped approach to reducing transport emissions towards 2050:

- Reduce CO_2 emissions per person km;
- Stabilise total CO_2 emissions; and
- Reduce CO_2 emissions in line with expectations from the emerging Climate Change Bill (60% reduction by 2020 / 80% reduction overall by 2050).

The most relevant stated project objective in regard to influencing material resource use and waste management within the A96 Dualling Programme SEA Post Adoption Statement is, as follows:

'*To minimise the environmental effect on the communities in the corridor.***'**

17.4.4 Receptor types likely to be at risk of impacts under this topic include:

- resource depletion from quarries, other sources of minerals and other finite raw material resources; specific sources of raw materials to be used for this proposed Scheme have not yet been identified but a list of potential sources has been outlined in Table 17.5;
- registered waste sites: Table 17.6 sets out all operational waste sites with permitted and remaining capacity in Highland, Moray and Aberdeenshire Council areas and they are also shown on Figure 17.1;
- the capacity of waste management infrastructure, such as landfills, material recovery facilities, energy from waste plant and waste transfer stations etc. as shown on Figure 17.1; and
- national and local policy targets relevant to materials and wastes (see above).

Materials

17.4.5 There is capacity to supply minerals and aggregates within THC and Moray Council areas. The adopted Highland-wide Local Development Plan 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.'

17.4.6 The adopted Moray Local Development Plan states that Policy ER4: Minerals will:

'ensure that there is a minimum 10 year landbank of permitted reserves for construction aggregates.'

17.4.7 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 areas (approximately 43% of hard rock and 12% of sand and gravel).

17.4.8 Around 85 to 90% of crushed rock quarried is retained within the area where it was produced; however the exception to this rule is the coastal quarry at Glensanda in the Highlands 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.

17.4.9 There are a number of active quarries and sand and gravel pits within the area which would be suitable for the sourcing of high quality aggregates, typically used for road pavement construction, and it is the expectation that as much of the materials as possible will be sourced locally. It is up to the appointed contractor to construct the proposed Scheme to source materials for the project and typically they will look to use local suppliers and to re-use materials on site to reduce costs. The use of such reclaimed waste material will be controlled in accordance with specifications within the Manual of Contract Documents for Highway Works (MCHW).

17.4.10 Table 17.5 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 Leiths Quarry, Forres.

Table 17.5: Active Quarries in the Area of the Proposed Scheme

Quarry	Distance from Gollanfield	Resource Available	Quantity Available
Achilty Quarry (Leith's)	29 miles	Aggregate and Recycled Aggregate	Not Known
Mid Lairg Quarry (Daviot A Ross & Sons)	16 miles	Sand, Gravel, Road Base, and Recycled Aggregate	6,000 tonnes per day
Balblair Quarry (Breedon Aggregates)	22 miles	Aggregate and Recycled Aggregate	Not Known
Blackcastle Quarry – Tarmac (Caledonian Quarry Products)	3 miles	Sand and Gravel	160,000 tonnes Subject to planning permission for quarry extension
Daviot Quarry (Breedon Aggregates)	11 miles	Asphalt	Not Known
Netherglen Quarry (Breedon Aggregates)	32 miles	Crushed Rock and Asphalt	Not Known
Lochinver Quarry – Tarmac	27 miles	Sand and Gravel	Existing reserve = 39,000 tonnes + 3 million tonnes Based on approved planning application to Moray Council (11/01792/EIA)
Gransh Quarry (David Ritchie & Sons)	39 miles	Sand, Gravel, and Recycled Aggregate	Not Known
Limehillock Quarry (Keith)	40 miles	Aggregate	Not Known
Limehilllock Quarry (Buckie)	40 miles	Aggregate	Not Known
New Forres Quarry (Leiths)	18 miles	Crushed Rock	Not Known
Dalmagarry Quarry (Pat Munro)	24 miles	Sand and Gravel	1,000,000 tonnes Based on planning application committee report dated December 2014
Classach Quarry (Duffus)	26 miles	Sandstone	Not Known
Cays Briggs Quarry - Tarmac	32 miles	Sand and Gravel	Not Known

17.4.11 Due to European Union competition regulations, it is not possible to prescribe materials sources, however, based on the quantities of material reserves available both from local quarries and throughout Scotland, it can be reasonably inferred that the materials required for the Scheme will predominantly be locally available, although the material demand is relatively large. As such, the materials use receptor sensitivity is determined to be moderate.

Waste Site Capacity

17.4.12 Section 4.50 of draft HD212/11 sets out that the value/sensitivity of 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 varying waste management infrastructure availability and capacity. For the purposes of this assessment it encompasses the Highland, Moray and Aberdeenshire Council areas.

Scotland

17.4.13 When waste is created, priority is given to preparing it for reuse, then recycling, then recovery, and last of all disposal to licensed off-site facilities. According to the SEPA Waste Site and Capacity Tool, the total quantity of controlled waste disposed to landfill in Scotland in 2014 was 4,016,789 tonnes. Of this, 73,569 tonnes were disposed to landfill in Highland, 400,815 to landfill in Aberdeenshire, and 44,836 tonnes were disposed of to landfill in Moray. In 2014, there were 58 operational landfills in Scotland (19 inert, 38 non-hazardous and one hazardous).

17.4.14 The 19 operational inert waste landfills had a remaining capacity of 7,365,206 tonnes at the end of 2014.

17.4.15 The remaining capacity of the 38 operational non-hazardous landfills at the end of 2014 was 54,356,730 tonnes.

17.4.16 The only active hazardous landfill site in Scotland in 2014 was Avondale in Falkirk. 25,711 tonnes were landfilled at this site in 2014, leaving a remaining capacity of 194,626 tonnes at the end of the year.

Highland, Moray and Aberdeenshire Council Areas

17.4.17 As discussed in paragraph 17.5.19 most of the waste generated from the proposed Scheme will be construction and demolition waste (C&D). The SEPA Waste Site and Capacity report for Scotland 2014 (SEPA 2014) identifies a total of 65 operational waste sites in THC area, 71 operational waste sites in Aberdeenshire, and 11 in the Moray Council area. Table 17.6 below details the annual permitted capacity of these sites in 2014 (excluding sites that offer only civic amenity facilities and pet crematoria), the tonnage of waste that was accepted in that year and the remaining capacity at the end of 2014. The location of these sites is shown in Figure 17.1 (as informed by SEPA's Waste Site and Capacity Tool, SEPA).

Table 17.6: Operational Waste Sites Permitted and Remaining Capacity 2014 in The Highland, Moray and Aberdeenshire Council Areas

Waste Site Type	Operational Site Permitted Capacity (Tonnes / annum) 2014				Waste Accepted (Tonnes) 2014	Remaining Capacity (Tonnes) 2014
	THC	Moray Council	Aberdeen-shire Council	Total	Total	Total
Civic amenity / Other treatment*	5,000	n/a	n/a	5,000	2,500	2,500
Civic amenity / Transfer station*	41,500	114,000	n/a	155,500	63,250	92,250
Civic amenity / Transfer station / Other treatment*	1,000	n/a	n/a	1,000	115	885
Composting	n/a	n/a	72,500	72,500	21,250	51,250
Composting / Other treatment	n/a	n/a	97,600	97,600	8,100	89,500
Incineration	105	n/a	n/a	105	15	90
Landfill	359,000	n/a	655,000	1,014,000	399,000	615,000
Landfill / Civic amenity*	n/a	122,000	n/a	122,000	46,000	76,000
Landfill / Civic amenity /	85,000	n/a	n/a	85,000	46,500	38,500

Waste Site Type	Operational Site Permitted Capacity (Tonnes / annum) 2014				Waste Accepted (Tonnes) 2014	Remaining Capacity (Tonnes) 2014
	THC	Moray Council	Aberdeen -shire Council	Total	Total	Total
Composting*						
Landfill / Civic amenity / Other treatment*	26,000	n/a	n/a	26,000	13,250	12,750
Landfill / Other treatment	n/a	n/a	100,000	100,000	129,000	-
Landfill / Transfer Station / Other Treatment	n/a	n/a	75,000	75,000	74,500	500
Landfill / Transfer station / Composting / Other treatment	45,000	n/a	n/a	45,000	16,000	29,000
Metal recycler	12,725	27,250	29,700	69,675	12,775	56,900
Metal recycler / Transfer station	54,575	75,000	25,000	154,575	57,875	96,700
Metal recycler / Transfer station / Other treatment	87,000	n/a	n/a	87,000	3,000	84,000
Other treatment	30,600	n/a	209,500	240,100	103,500	136,600
Transfer station	423,650	n/a	666,150	1,089,800	415,300	674,500
Anaerobic Digestion	n/a	n/a	50,000	50,000	36,800	13,200
Transfer station / Anaerobic digestion	4,000	n/a	n/a	4,000	4,364	-
Transfer station / Composting	50,000	20,800	n/a	70,800	52,800	18,000
Transfer station / Other treatment	79,000	n/a	532,100	611,100	184,600	426,500

*sites without Civic amenity will be used in preference.

17.4.18 In 2014, two operational inert landfills and three operational non-hazardous landfills were recorded in THC area. There were three operational inert landfills and three operational non-hazardous landfills recorded in Aberdeenshire, and one non-hazardous landfill was recorded in the Moray Council area.

17.4.19 The figures for the total amount of inert waste disposed of to landfill in 2014, and the remaining capacity, for each council area are outlined in Table 17.7.

Table 17.7: Total Used and Remaining Capacity of Operational Landfills (Inert and Non-hazardous) 2014 in Highland, Moray and Aberdeenshire Council Areas

Type of Landfills	2014 Capacity (Tonnes)			
	THC	The Moray Council	Aberdeenshire Council	Total
Inert Landfills				
Used	8,042	n/a	41,771	49,813
Remaining	295,025	n/a	2,299,183	2,594,208
Non-hazardous Landfills				
Used	65,554	44,836	359,044	469,434
Remaining	848,000	400,000	2,052,740	3,300,740

17.4.20 Table 17.8 provides more details of these sites, and their location is given in Figure 17.1 (information from SEPA's Waste Site and Capacity Tool).

Table 17.8: Permitted and Remaining Capacity of Operational Landfills (Inert and Non-hazardous) 2014 in Highland, Moray and Aberdeenshire Council Areas

Operational Landfills, 2014	Annual Capacity on Permit (Tonnes)	Remaining Capacity on 31 December 2014	Distance and Orientation from proposed Scheme
Inert Landfills			
John Gunn & Sons Limited, Skitten Quarry, Wick, Highland	25,000	74,858	Circa 120 – 150km to the north
DW3100 LLWF Landfill, Dounreay, Highland	334,000	220,167	Circa 190 – 220km to the north
Loch Hills Quarry, Parkhill, Dyce, Aberdeenshire	100,000	1,427,183	Circa 120 – 150km to the south-east.
Park Quarry, South Deeside Road, Aberdeen, Aberdeenshire	75,000	852,000	Circa 140 – 170km to the south-east
A& M Smith, Bankhead, Portlethen, Aberdeenshire	25,000	20,000	Circa 140 – 170km to the south-east
Total of Inert Landfills	559,000	2,594,208	
Non-hazardous Landfills			
Granish Landfill Site Cell 3, by Aviemore, Highland	25,000	76,000	Circa 45 – 55km to the south
Seater Landfill Site, Bower, by Wick, Highland	65,000	276,000	Circa 130 – 160km to the north
Duisky Landfill Site, Kinlocheil, Fort William, Highland	24,000	496,000	Circa 180 – 210km to the south-west
Savoch Landfill, Newton of Savoch, Aberdeenshire	25,000	68,000	Circa 140 – 170km to the east
Stoneyhill Landfill Site, Aberdeenshire	355,000	1,864,195	Circa 140 – 170km to the east
Easter Hatton Farm, Balmedie, Aberdeenshire	200,000	120,545	Circa 130 – 160km to the east
Nether Dallachy Landfill Site, Moray	120,000	400,000	Circa 50 – 80km to the east
Total of Non-hazardous Landfills	**814,000**	**3,300,740**	**-**
Total Combined	**1,373,000**	**5,894,948**	**-**

17.4.21 Given the above, it can be inferred that there is waste management capacity appropriate for the types of waste arising from the proposed Scheme, when considering the wider area of THC, Moray and Aberdeenshire. As such, the waste receptor sensitivity is determined to be **low**.

17.5 Impacts – Site Preparation, Clearance, Demolition and Construction

Material Resources

17.5.1 The types of materials likely to be required for construction are common to all road schemes. Indicative estimated quantities of the major materials are provided in Table 17.9, as well as the likely worst case scenario including a 10% contingency to cover any unknown items.

Table 17.9: 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	5,163,000	5,679,300	N/A
Pavement (surfacing, binder and base)	m^3	151,000 121,000 Cement Bound Material (CBM) lower base	166,100 133,100	Surface – 10 years Binder – 20 years Base – 40 years
Sub-base	m^3	235,000 Type 1	258,500	40 years

Material	Units	Approximate Estimated Quantity	Worst Case Scenario Quantity (Including 10% Contingency)	Assumed Indicative Replacement Frequency
Concrete	m^3	33,100	36,410	100 years
Steel	Tonnes	2,300	2,530	100 years
Drainage Filter Material	m^3	54,000	59,400	10 years
Kerbs	m	20,500 43,000 edge kerbing	22,550 47,300	40 years
Road markings	m	41,000	45,1000	10 years
Safety Barriers	m	92,900	102,190	25 years
Boundary Fencing	m	166,000	182,600	25 years
Signage	m^2	2,146	2,360	20 years

17.5.2 A proportion of both building materials and composite components used during the construction process will inevitably end up as waste. The Waste and Resources Action Programme (WRAP) has published a Net Waste Tool 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, but is designed to help project teams identify their major sources of waste, and the most significant opportunities to take action.

Aggregates

17.5.3 Imported aggregates are likely to be required for earthworks, structures, drainage and road pavement construction. As set out in Section 17.4 (Baseline Description and Evaluation), it is assumed that materials required for the proposed Scheme would be sourced locally close to Inverness 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.

17.5.4 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 M2** and **M3** respectively) which are further explored in Section 17.8 (Mitigation).

17.5.5 Within THC and Moray Council areas there is capacity to supply high quality aggregate material as outlined in Section 17.4 (Baseline Description and Evaluation). Table 17.5 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 local sources. However, due to European Union competition regulations, it is not possible to prescribe materials sources.

Earthworks

17.5.6 The proposed Scheme will require additional materials to be imported and excess, unusable, materials exported, as illustrated by the estimated earthworks quantities for construction provided in Table 17.10 below. The import quantity shown is additional to any 'site won' material re-used on-site. The export quantities of material shown in Table 17.10 equate to those materials unsuitable for re-use on site, including some areas of peat and identified soft ground that will need to be disposed of off-site. Further details on the impact of the proposed Scheme on peat and how the peat would be managed is provided in Chapter 12 (Geology, Soils and Contaminated Land and Groundwater).

17.5.7 The total estimated import and export values for earthworks are currently 2,888,000m^3 and 90,000m^3 accordingly. With a 10% contingency, the worst case scenario figures are 3,176,800m^3 estimated import and 99,000m^3 estimated export volumes.

Table 17.10: Earthworks Volume Estimates (Excluding On-site Acceptable Material which does not require Import or Export)

Earthworks	Approximate Volume (m3)	Worst Case Scenario Volume with 10% Contingency (m^3)
Estimated Import	2,888,000	3,176,800
Estimated Export	90,000	99,000

17.5.8 The design process has sought to identify where earthwork materials can be re-used from the existing A96 and where some of the materials required for earthworks can be used for specialist purposes. 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

17.5.9 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 C&D waste. WRAP identifies C&D wastes as waste materials arising from UK commercial C&D 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.

17.5.10 The WRAP Net Waste Tool has been applied to the materials volumes estimated for the proposed Scheme, and the estimated waste arisings are presented in Table 17.12.

17.5.11 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 licensed off-site facilities. If, as in this case, there is likely to be adequate local waste management capacity to deal with the waste arising from the proposed Scheme, the waste receptor sensitivity is determined to be low as per Table 17.2. Waste management would become a concern of high importance if there was a risk of filling local facilities up to capacity, thereby forcing locally-produced wastes to be transported greater distances for disposal elsewhere.

Demolition Wastes

17.5.12 The disused building at Smithton Junction, the Gollanfield Rail Underbridge and Kildrummie Rail Bridge, and the Milton of Culloden Shed shown on Figure 17.2 would need to be demolished for construction of the proposed Scheme, which would contribute to the quantity of the overall demolition waste generated and associated recycling activities. It is anticipated that the stone from the building could be recycled but, as the bridge will be dismantled late in the construction programme, it is unlikely that there would be an opportunity to reuse these materials on-site. They will be removed from site, and if it is not possible to find opportunities for re-use or recycling off-site, as a last resort they will be sent to licensed landfill for disposal.

17.5.13 The demolition waste generated by the proposed Scheme would also include items such as redundant safety barriers and lighting columns, but the overall quantity would be limited and re-used or recycled wherever feasible.

17.5.14 The following demolition wastes are likely to be produced and, in order to present a worst case scenario, include a 10% contingency. It is considered that the majority (~90% barring earthwork soils) would be returned to the manufacturer, re-used or recycled. However, a proportion of the wastes from demolition may require disposal to landfill. Estimated tonnages of the various demolition waste types expected are set out in Table 17.11.

Table 17.11: Estimated Waste Arisings from Demolition (Including 10% Contingency), Tonnes

Material	Quantity (tonnes) *			Milton of Culloden Shed	Total
	Disused building at Smithton	Gollanfield Rail Bridge	Kildrummie Rail Bridge		
Blockwork	197		147		344
Concrete	85	894			979
Timber	10			2	12
Plaster	4.2				4.2
Slate	5				5
Metals	Unknown				Unknown
Insulation	0.3				0.3
Glass	0.6				0.6
Total	**302.10**	**894**	**147**	**2**	**1,345.10**

* Based on DMRB Stage 3 design. Quantities are approximate and indicative only

17.5.15 Wastage rates in the Net Waste Tool exist in two forms, baseline and good practice, the latter being associated with Modern Methods of Construction (MMC). The rise of MMC has resulted in a reduction in construction waste generated on-site of up to 90% for specific building components. As MMC will be used in the construction of the proposed Scheme the good practice wastage rates have been applied to the estimated materials volumes, and the estimated waste arisings are presented in Table 17.12 below. Earthworks are addressed separately (paragraphs 17.5.6 to 17.5.8).

Table 17.12: 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	299,200	2.50%	7,480
Sub-base	m^3	258,500	5.00%	12,925
Concrete	m^3	36,410	2.50%	910
Steel	Tonnes	2,530	5.00%	127
Drainage Filter Material	m^3	59,400	5.00%	2,970
Kerbs	m^3	1,200	2.50%	30
Road markings	m^3	23	0%	-
Safety Barriers	m^3	14,400 concrete barrier 605 steel	5.00%	720 30
Boundary Fencing	m^3	3,650	5.00%	182.50
Signage*	m^2	2,360	0%	-

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

17.5.17 Existing on-site soils, infrastructure and demolition 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;
- road planings, which could be incorporated into new pavements on or off-site; and
- building demolition material.

17.5.18 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, the proposed Scheme will require additional materials to be imported and some excess, unusable materials to be exported as shown in Table 17.11.

Earthworks Balance

17.5.19 Estimated quantities have also been calculated for pavement sub-base, top-soils and earthworks materials that are likely to require re-use / export off-site. These would amount to ~1,674,000 tonnes (~837,000m^3), and ~1,841,400 tonnes (~920,700m^3) in a worst case scenario with a 10% contingency.

17.5.20 Although the proposed Scheme seeks to achieve an earthworks balance in order to reduce the need for earthworks materials to be disposed of off-site, there would be some surplus fill material which would require export from the site. Under section 7 of the Land Remediation and Waste Management Guidelines (SEPA, 2009), existing soils and infrastructure removed during the construction works would be considered as a waste if there is no possibility of recovering the material through recycling (on-site or off-site), or other processing that would enable re-use of the materials in the construction or elsewhere. Where re-use of any material is not possible, the material would need to be discarded and would thus become classified as waste. As illustrated in Section 17.4 (Baseline Description and Evaluation) there is currently landfill capacity in THC, Moray and Aberdeenshire Council areas for all the forecast earthworks waste arisings.

17.5.21 However, in accordance with the Zero Waste Plan (2010), wastes would be re-used or recycled off-site where possible. For example, Table 17.10 indicates that the amount of earthworks material needed to be imported is approximately three times that which is to be exported.

17.5.22 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

17.5.23 Other wastes may include:

- surplus organic materials including vegetation from shrub or tree clearance;
- hazardous wastes including contaminated soil and any asbestos (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).

17.5.24 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

17.5.25 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. Where suitable, such waste would be re-used or recycled, such as through on-site landscaping or ecological improvement works. The majority of woodland vegetation however would be chipped on-site and removed for composting at an external waste management facility.

Hazardous Wastes

17.5.26 Hazardous wastes may comprise any contaminated soils or demolition waste 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 or demolition waste during construction can also lead to the release of chemical pollutants into the air, ground or water (remobilisation of contaminants). The potential for waste materials or land uses to generate contaminated soils or groundwater is discussed in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater).

17.5.27 Prior to demolition, the disused building at Smithton Junction and the shed at Milton of Culloden (Figure 17.2) would be subject to an intrusive survey to determine the presence of asbestos prior to work commencing. The waste produced from removal activities would be disposed of in accordance with the Special Waste Amendment (Scotland) Regulations 2004, The Control of Asbestos Regulations 2012 and SEPA (2015) Guidance: Asbestos in Demolition Wastes. Any asbestos found is likely to require disposal approximately 250km away at the Avondale Hazardous Waste Landfill near Falkirk, which is the only hazardous waste landfill in Scotland. Avondale Landfill has an annual capacity of 200,000 tonnes, and at 31 December 2014 there was 194,626 tonnes of capacity remaining.

Municipal Solid Wastes

17.5.28 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 17.4 (Baseline Description and Evaluation). However, segregation facilities would be provided to ensure that recovery and recycling of such wastes is maximised.

Surplus Materials

17.5.29 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

17.5.30 In regard to dust impacts from demolition and construction Chapter 7 (Air Quality) concludes that with the implementation of appropriate dust management measures there will 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).

17.6 Carbon Assessment

17.6.1 A detailed assessment of the potential carbon dioxide equivalent (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 CMS. 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).

17.6.2 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.

This information allowed for the calculation of material use, which is presented below in Table 17.13 by broad material type and construction components.

Table 17.13: Carbon Emissions by Broad Material Type and Construction Components.

Project Elements	Material Types	Units	Worst Case Scenario Quantity (Including 10% Contingency) (unit listed)
Earthworks	Soil	m^3	5,679,300
	Of which imported	m^3	3,176,800
Pavement	Surface, binder and base	m^3	299,200
Sub-base	Sub-base material	m^3	258,500
Structures (civils & buildings)	Precast reinforced concrete	m^3	36,410
	Steel	tonnes	2,530
Drainage	Drainage filter material	m^3	59,400
Kerbs	Concrete, 150mm x 250mm and 50mm x 150mm	m^3	1,200
Safety Barriers	Steel, single sided	m^3	605
	Concrete barriers	m^3	14,400
Boundary Fencing	Timber fencing	m^3	3,650
Signage	Metal-backed signage	m^2	2,360

17.6.3 The source data was inputted into the CMS 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 below in Table 17.14.

Table 17.14: Project Emissions Summary

Carbon source	Worst Case Scenario tCO_2e (Including 10% Contingency)
Total project carbon emissions	**1,080,250**
Construction: Materials embodied	266,250
Construction: Transport of material and waste	14,250
Maintenance: Materials embodied	799,750

17.6.4 Based on the assumptions above the CMS tool estimates the project's worst case scenario whole life carbon emissions to be 1,080,190tCO_2e, including a 10% contingency. The magnitude of the impact of the proposed Scheme is therefore considered to be major based on the guidance within draft HD212/11 (as outlined in Table 17.1). This guidance considers emissions over 40,000tCO_2e to be major using benchmark data from previous road projects.

17.6.5 It should be noted that the data used to develop the CMS are indicative estimates from the DMRB Stage 3 design and are subject to change. In addition to the above, draft HD212/11 sets out at

Annex 1 (Worked Examples), Example 3, (detailed assessment), a similar scenario to the above (over 40,000tCO_2e was calculated), in which it states:

> *'However, the assessment also notes very clearly that mitigation measures are in place to ensure that excavated materials and construction wastes would be re-used within the project thereby reducing overall material demand.'*

17.6.6 This assessment is comparable to that example as excavated materials and construction wastes would, where possible, be re-used which would reduce the overall material requirements for the proposed Scheme. It should also be noted that equivalent scale roads infrastructure projects throughout Scotland and the UK that have calculated a similar major magnitude have been approved on the basis of the suggested mitigation and the acceptance that essential roads infrastructure schemes of this scale would normally require a significant amount of materials to construct.

Other Relevant Assessments

17.6.7 In regard to ongoing impacts during operation Chapter 7 (Air Quality) outlines that there will be no significant effects on local air quality and therefore no mitigation is required. Chapter 8 (Noise and Vibration) predicts that there will be an overall reduction in noise nuisance with the proposed Scheme compared to without it. In regard to soils and contaminated lands Chapter 12 (Geology, Soils, Contaminated Land and Groundwater) outlines that during operation there is potential for direct interaction but with a reduced likelihood on comparison with the construction phase (except for made ground potentially re-used on site). In regard to indirect impacts it identifies that maintenance personnel could be at risk through pathway PP12 of having contact with contaminated groundwater. However, the potential of this occurring has been assessed as low likelihood with an impact magnitude of medium, resulting in potential impact of Moderate/Low significance.

17.7 Summary of Direct, Indirect, Temporary and Cumulative Impacts

17.7.1 Draft HD212/11 defines direct impacts as '*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 waste which requires treatment and disposal in suitable permitted waste management facilities, such as asbestos or contaminated soils.

17.7.2 Draft HD212/11 defines 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 a direct effects.

17.7.3 Draft HD212/11 defines temporary impacts 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.

17.7.4 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. Interactions may arise from activities related to other topics, such as Soils and Geology.

Impact Summary and Magnitude / Significance Evaluation

17.7.5 The impacts identified for both materials and waste above, and their magnitude / significance are summarised in the Detailed Assessment Reporting Matrix in Table 17.16.

Table 17.15: Detailed Assessment Reporting Matrix

Project Activity	Potential Impacts Associated With Material Use / Waste Production	Description of the Impacts
Site Remediation / Preparation / Demolition	Disposal of demolition wastes and soils unsuitable for use on-site	If waste requires landfill disposal / treatment off site, there is adequate waste management capacity, . Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse** If waste can be re-used at other construction sites the magnitude of effect could be reduced thereby reducing significance.
	On-site use of demolition wastes, soils and green waste	Relatively limited volumes of materials can be used for construction works but some soils and green wastes can be used for landscaping. Impact = low sensitivity, but major magnitude, short-term, localised and adverse impact. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse**
	Production of hazardous wastes (e.g. asbestos)	No or low volumes expected. Transport for disposal 250km away in Falkirk. No or low volumes of asbestos expected. Contamination issues dealt with in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater). Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse** if realised.
Construction	Material use and depletion (e.g. virgin aggregates)	Materials predominantly available locally but the material demand is relatively large, so the sensitivity is assessed as medium as detailed in paragraph 17.3.12. Value (sensitivity) of receptor: **Medium** Magnitude of impact: **Moderate adverse, short-term and localised** Significance of impact: **Moderate Adverse**
	Carbon footprint of materials use	Magnitude of impact: **Major Adverse** Embodied carbon of construction materials and waste (not including transport) =~ 266,250tCO_2e including 10% contingency (>40,000tCO_2e).
	Transport of materials and wastes	Magnitude of impact: **Minor Adverse** Embodied carbon estimated at ~14,250tCO_2e Worst Case Scenario (i.e. between 5,000 and 20,000). However, poor planning of materials use could lead to excessive use of plant and vehicles to move and handle bulk materials, resulting in inefficient use of energy.
	Wastes from materials use and municipal solid waste production	Except in relation to demolition wastes it is anticipated that ~90% of soils and wastes would be recycled. There is adequate recycling capacity such that sensitivity is low, but there is the likelihood that some waste would be sent off-site for recycling or back to the manufacturer so the magnitude is minor. Municipal solid waste production is expected to be minimal. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Minor adverse, short-term and localised**

Project Activity	Potential Impacts Associated With Material Use / Waste Production	Description of the Impacts
		Significance of impact: **Neutral Adverse**
Operation	Carbon footprint of replacement materials	Magnitude of impact: **Major Adverse** Embodied carbon of materials for maintenance (including transport) = ~799,750tCO_2e including 10% contingency (>40,000tCO_2e).

17.8 Mitigation

General

17.8.1 Mitigation measures for the proposed Scheme in relation to the Materials Assessment are detailed below and take into account best practice, legislation, guidance and professional experience. The mitigation commitments identified in the SEAs for the STPR (Jacobs, Faber Maunsell, Grant Thompson and Tribal Consulting 2008) and A96 Dualling Programme (CH2M 2015 and 2016) have also been taken into consideration.

17.8.2 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 would be implemented to minimise both the use of materials and the generation of waste in relation to the proposed Scheme.

17.8.3 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.

17.8.4 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.

17.8.5 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.

17.8.6 The principles of the waste hierarchy (Diagram 17.1) would 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 M1: Compliance with All Relevant Waste Legislation

17.8.7 For all potential waste arisings, the appointed contractor will be required to comply with The Waste Management Licensing (Scotland) Regulations 2011 (WML). Consideration would 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 Environment Agency Pollution Prevention Guidelines (PPGs) including PPG06 – Working at Construction and Demolition Sites (amongst others). If necessary, the appointed contractor would consult SEPA for advice. If wastes could not be legitimately re-used on site, they would be removed to a licensed recycling or disposal facility in line with regulatory requirements.

17.8.8 Given the relatively small scale of the proposed demolition i.e. the disused building at Smithton Junction and the Milton of Culloden shed, Gollanfield Rail Underbridge and Kildrummie Rail Bridge (paragraph 17.5.12), a pre-demolition audit would be completed using an appropriate method (e.g. the Institution of Civil Engineers (ICE) has produced guidance on pre-demolition audits, including 'The Demolition Protocol' (2008) and Zero Waste Scotland (ZWS) / WRAP also provide guidance). The audit would be referenced in the Site Waste Management Plan (SWMP) (see further below).

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

Mitigation Item M1 and GR1: Implementation of a Construction Environmental Management Plan (CEMP)

17.8.10 A principal mitigation measure relating to this topic would be the development and implementation of a CEMP. The CEMP would be developed by the appointed Contractor during the detailed design phase (i.e. before the start of construction works) and implemented as part of any advance demolition contract and during the construction phase. The CEMP would include the following:

- 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 A90 and A96. Prescribed routes would be included in the main construction contract documents. The appointed 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.

17.8.11 Chapter 7 (Air Quality) states for mitigation that in the CEMP best practice measures to control fugitive dust would be employed. Chapter 8 (Noise and Vibration) sets out that mitigation measures will be included in the CEMP. Chapter 12 (Geology, Soils, Contaminated Land and Groundwater) outlines that a site specific chemical analysis is not available at the time of writing. Once received a risk assessment would be undertaken and mitigation, if required, would be specified on a site by site basis. The key mitigation measures include:

- storage of excavated made ground material using bunded facilities and development of re-use criteria;
- removal of contaminated soils from site;
- consolidation for treatment ex situ; and/or
- treatment in situ (of soil and/or water).

Mitigation Item M1: Implementation of a Site Waste Management Plan (SWMP)

17.8.12 Though not mandatory in Scotland, a SWMP would be developed, either as part of the CEMP or as a separate document, and would be regularly updated during construction of the route. The plan would identify, prior to the start of construction works, the types and likely quantities of wastes that may be generated. It would set out, in an auditable manner, how waste would 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 appointed contractor before commencement of the construction phase and any advance demolition contract and would include waste minimisation targets and associated KPIs. It would be written in accordance with ZWS and WRAP guidance.

17.8.13 The SWMP would set out how all construction phase materials would be managed. This may include 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; and

- 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.

17.8.14 Implementation of the SWMP would 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 would enable the monitoring of the effectiveness of the mitigation measures at minimising waste generation, especially disposal to landfill.

Mitigation Item M1: Application of Waste Hierarchy

17.8.15 Where possible, any site won materials will be re-used within the proposed Scheme. Where materials generated during demolition / construction cannot be used for the proposed Scheme, opportunities would 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, but it would not be possible to confirm this until closer to the time of implementing the works. It is acknowledged that any soils or peat stored for greater than three years would require a permit under The Landfill (Scotland) Regulations 2003.

17.8.16 As referenced in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater). a Peat Management Plan should be developed by the appointed contractor exploring the possibility of using engineering methods such as piling or in-situ stabilisation which would seek to reduce the volumes of peat to excavate as well as the possible ways of maximising peat re-use. (Mitigation Item G1).

17.8.17 Where suitable, green waste would 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. 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). Details of any specific proposed ecological improvement works are outlined in Chapter 11 (Habitats and Biodiversity).

17.8.18 In addition to the above, the use of, for example, geotextiles to considerably reduce the quantity of fill material required by improving the strength of structures will be investigated.

Mitigation Item M1: Hazardous Wastes

17.8.19 If contaminated soils are encountered during the construction works, further investigation, testing and risk assessment shall be undertaken to determine whether the soils could stay on-site, would require treatment to make them suitable to remain on-site, or would need to be disposed of off-site. Details for dealing with unexpected contaminated soils would be included in the CEMP.

Mitigation Item M2: Asbestos

17.8.20 Asbestos surveys of the structures to be demolished (disused property at Smithton and the Milton of Culloden shed, Gollanfield Rail Bridge and Kildrummie Rail Bridge) would also be undertaken prior to any demolition works commencing and appropriate management and disposal routes identified.

Carbon Saving Measures

17.8.21 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.

17.8.22 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.

17.8.23 With this in mind, the key early intervention procedure, as identified in the Infrastructure Carbon Review (HM Treasury 2013), 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.

17.8.24 In the first instance, 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.

17.8.25 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.

17.8.26 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 will not significantly alter the safety and driving characteristics of the road, soil fill should be reduced.

17.8.27 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 69% 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

17.8.28 Table 17.16 summarises measures that would be adopted in accordance with Annex 4 of the draft HD 212/11 guidance.

Monitoring and Management

17.8.29 It is anticipated that, once complete, the proposed Scheme will be maintained by Transport Scotland's Operating Company.

Table 17.16: Mitigation Measures Reporting Matrix

Project Activity	Potential Impacts Associated With Material Resource Use / Waste Management	Description of the Mitigation Measures	Mitigation Reference	How the Measures Would be Implemented, Measured, and Monitored
Site Remediation / Preparation / Demolition	Disposal of demolition wastes and soils unsuitable for use on-site	Site Waste Management Plan (SWMP) including use of targets as Key Performance Indicators (KPIs). Market testing for the use of wastes off-site via the materials exchange. Pre-demolition audit to identify wastes.	**M1**	Implemented by appointed contractor. Use of weighbridge records and waste transfer notes. Audited regularly by Environmental Coordinator / Clerk of Works
	On-site use of demolition wastes, soils and green waste	SWMP and KPIs. Pre-demolition audit.	**M1**	Incorporation of on-site recovered materials in detailed design. Implemented by appointed contractor. Audited regularly by Environmental Coordinator / Clerk of Works
	Production of hazardous wastes (e.g. asbestos)	SWMP. Detailed surveys for asbestos in structures prior to demolition. On-site or off-site treatment of contaminated soils for any other hazardous wastes identified on-site, as appropriate.	**M1, M2**	Detailed asbestos survey results, 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)	Construction Environment Management Plan (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. Pre-demolition audit to identify resources.	**M1**	Procurement policies to be implemented by the appointed contractor. Measured via weighbridge records and receipts and analysis of procurement criteria used for specific materials. Audited regularly by Environmental Coordinator / Clerk of Works
	Carbon footprint of materials use	As above	**M1, Carbon saving measures**	As above. Procurement policies to include whole life CO2e emissions data as a KPI for all materials.
	Transport of materials and wastes	As above and use of 'just-in-time' delivery to minimise double handling. Sensitive traffic management to minimise effects on amenity.	**M1**	Procurement and waste management policies and sensitive routing arrangements to be implemented by the appointed contractor. Measured via weighbridge records and receipts and analysis of procurement criteria used for specific materials. Audited regularly by Environmental Coordinator / Clerk of Works
	Wastes from materials use and municipal solid waste production	SWMP and KPIs. Provision of segregation facilities.	**M1**	Implemented by appointed contractor. Use of weighbridge records and waste transfer notes. Audited regularly by Environmental Coordinator / Clerk of Works
Operation	Carbon footprint 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.	**Carbon saving measures**	Ongoing procurement policies to include whole life CO2e emissions data as a KPI for all maintenance materials.

17.9 Residual Impacts

17.9.1 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). 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. The proper application of these management procedures should reduce the significance of all of waste impacts described in this chapter to Slight or Neutral as illustrated in Table 17.17.

17.9.2 The magnitude of the proposed Scheme's carbon emissions during construction and operation will be Major as set out in Table 17.1 (Materials (Carbon) Assessment Magnitude Criteria).

17.9.3 It should be noted that at all stages of the project the appointed contractor would be obliged 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 accord with relevant legislation, policy and guidance as set out in this chapter.

17.9.4 The magnitude and / or significance of each residual impact are described in Table 17.17.

Table 17.17: Residual Impacts Matrix

Project Activity	Potential Impacts Associated With Material Use / Waste Production	Description of the Impacts Prior to Mitigation	Description of the Impacts After Mitigation
Site Remediation / Preparation / Demolition	Disposal of demolition wastes and soils unsuitable for use on-site	If waste requires landfill disposal / treatment off site, there is adequate waste management capacity, Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse** If waste can be re-used at other construction sites the magnitude of effect could be reduced thereby reducing significance.	If waste can be re-used at other construction sites the magnitude of impact is reduced to negligible and thus significance could be reduced to **Neutral**. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Negligible** Significance of impact: **Neutral**
	On-site use of demolition wastes, soils and green waste	Relatively limited volumes of materials can be used for construction works but some soils and green wastes can be used for landscaping. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse**	If the reuse of such wastes on site can be maximised the magnitude of the impact can be reduced to moderate resulting in a significance level of **Slight Adverse.** Value (sensitivity) of receptor: **Low** Magnitude of impact: **Moderate adverse, short-term and localised** Significance of impact: **Slight Adverse**
	Production of hazardous wastes (e.g. asbestos)	No or low volumes expected. Transport for disposal 250km away in Falkirk. No or low volumes of asbestos are expected, but if discovered, must be landfilled. Contamination issues dealt with in Chapter 12 (Geology, Soils, Contaminated Land and Groundwater). Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight / Moderate Adverse** if realised.	If no asbestos / contamination is found through surveys there would be **No Impact** If asbestos / contamination is found then off site treatment would be required for contaminated soils or any hazardous wastes on-site Value (sensitivity) of receptor: **Low** Magnitude of impact: **Major adverse, short-term and localised** Significance of impact: **Slight Adverse**
Construction	Material use and depletion (e.g. virgin aggregates)	Value (sensitivity) of receptor: **Moderate** Materials are predominantly available locally but the material demand is relatively large.	If the use of local materials can be maximised, sensitivity would reduce to **Low**. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Moderate adverse, short-term and localised** Significance of impact: **Slight Adverse**
	Carbon footprint of materials use	Magnitude of impact: **Major Adverse** Embodied carbon of construction materials and waste (not including transport) = ~266,250 tCO_2e including 10% contingency (>40,000tCO_2e).	If carbon efficient procurement can be maximised during construction then there is the potential to reduce the total impacts but the magnitude is expected to remain **Major Adverse**.

Project Activity	Potential Impacts Associated With Material Use / Waste Production	Description of the Impacts Prior to Mitigation	Description of the Impacts After Mitigation
	Transport of materials and wastes	Magnitude of impact: **Minor Adverse** Embodied carbon footprint estimated at ~~14,250 tCO_2e including 10% contingency (i.e. between 5,000 and 20,000). However, poor planning of materials use could lead to excessive use of plant and vehicles to move and handle bulk materials, resulting in inefficient use of energy.	If vehicle movements are kept to a minimum through good planning, the magnitude is expected to remain **Minor Adverse** i.e. between 5,000 and 20,000.
	Wastes from materials use and municipal solid waste production	Except in relation to demolition wastes it is anticipated that ~90% of soils and wastes would be recycled. There is adequate recycling capacity such that sensitivity is low, but there is the likelihood that some waste would be sent off-site for recycling or back to the manufacturer so the magnitude is minor. Municipal solid waste production is expected to be minimal. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Minor adverse, short-term and localised** Significance of impact: **Neutral / Slight Adverse**	If waste of construction materials can be avoided and/or re-use on site can be maximised the magnitude of the impact can be reduced to negligible resulting in a significance level of **Neutral**. Value (sensitivity) of receptor: **Low** Magnitude of impact: **Negligible** Significance of impact: **Neutral**
Operation	Carbon footprint of replacement materials	Magnitude of impact: **Major Adverse** Embodied carbon of materials for maintenance (including transport) = ~799,750tCO_2e including 10% contingency (>40,000/).	If carbon efficient procurement can be maximised during the operational period then there is the potential to reduce the impacts but the magnitude is expected to remain **Major Adverse**.

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