14 Materials

14.1 Introduction

14.1.1 This chapter assesses the potential for the scheme to impact on material assets during construction through the acquisition and use of raw materials and resources, and the waste produced through surplus and general wastage. The topics assessed are:

- The use of material resources; and
- The generation and management of waste.

14.1.2 The assessment has been undertaken in accordance with the guidance set out in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Environmental Assessment (Ref 14.1), in conjunction with Interim Advice Note (IAN) 153/11, Guidance on the Environmental Assessment of Material Resources (Ref 14.2). The draft guidance published by Highways England on Materials was also used, HD212/11 (Ref 14.3).

14.1.3 The sensitivity of materials has also been assessed in accordance with the guidance set out in Table 2.1 of DMRB Volume 11, Section 2, Part 5, Assessment and Management of Environmental Effects, Chapter 2 Determining the significance of environmental effects (Ref 14.4) in conjunction with Interim Advice Note (IAN) 153/11.

14.1.4 It is beyond the scope of IAN 153/11 to assess the potential environmental impacts that are associated with the extraction and transport of primary raw materials and production of products, for example concrete, electrical lighting columns etc; therefore, this is not considered within this assessment.

14.1.5 Operational impacts have not been considered within this assessment as they are considered to be minor in comparison to construction phase impacts; small quantities of maintenance materials will be required along with small quantities of waste produced such as planings. However, at this stage these are not accurately quantifiable and will be of such small quantities that no significant effects are likely therefore operational impacts have been scoped out.

14.1.6 Materials are considered in this chapter through the review of the following:

- Material resource management – material resources include primary raw materials, such as aggregates and minerals and manufactured construction products which include recycled and secondary aggregates. Many material resources may originate offsite, purchased as construction products and some arise onsite such as excavated soils or recycled road planings. Materials shall be selected in accordance with Volume 1 of the Manual of Contract Documents for Highway Works – Specification for Highway

Works which contains the material specifications required in all components of the construction, improvement or maintenance of the Scottish Trunk Road network.

- Waste management – the potential environmental effects that are associated with the production, movement, processing, and disposal. Waste is defined in Article 1(a) of the European Waste Framework Directive 2008/98/EC as "any substance or object in the categories set out in Annex I which the holder discards or intends to discard or is required to discard". The term "holder" is defined as the producer of the waste or the person who is in possession of it and "producer" is defined as anyone whose activities produce waste. Waste can be further classified as hazardous, non-hazardous or inert. For surplus materials and waste, the potential environmental effects are associated with the production, movement, processing, and disposal of arisings from sites. Major new road construction projects or large-scale maintenance schemes might result in large quantities of surplus materials and waste leading to effects on the available waste management infrastructure.

14.2 Policy and Legislative Background

14.2.1 A desktop review of current legislation, planning policy and technical guidance was carried out to identify all relevant information to the scheme in relation to materials and waste. Legislation was reviewed by checking the following websites:

- Legislation.gov.uk (Ref 14.5)
- Netregs.org.uk/ (Ref 14.6)
- Gov.scot/Publications/Recent (Ref 14.7)
- Sepa.org.uk/regulations/ (Ref 14.8)

14.2.2 There are a number of policy and legislative instruments in the UK on the use of raw materials and disposal of waste as well as policy and guidance documents. The most relevant are summarised in Table 14-1.

Table 14-1: Regulatory and policy framework

Legislative / policy	Description
International	
The Waste Management Directive 2006/12/FC as amended by Directive 2008/98/EC (Ref 14.9)	Sets out aims of waste management and disposal for EU members so that waste is not disposed of in a manner that could impact on human health or the environment and encourages waste reduction, recycling and reuse.

Legislative / policy	Description
Waste Framework Directive 2008/98/EC (Ref 14.10)	This sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It explains when waste ceases to be waste and becomes a secondary raw material (end-of-waste criteria), and how to distinguish between waste and by-products.
National	
Environmental Protection Act 1990 (Ref 14.11)	This act established businesses' legal responsibilities for the duty of care of waste, contaminated land and statutory nuisance.
The Environment Act 1995 (Ref 14.12)	An act of parliament enacted to set up the Environment Agency and the Scottish Environment Protection Agency.
The Control of Pollution Act 1974 and Amendment 1989 (Ref 14.13)	An act of parliament put forward with the purpose of governing the disposal of waste and to regulate and control water, noise and atmospheric pollution; amended in 1989 in order to provide further governance specific to the disposal of waste materials.
The Environmental Protection (Duty of Care) Regulations 1991 (SI 2839) (Ref 14.14)	These regulations impose a duty of care on any person who imports, produces, carries, treats or disposes of controlled waste to ensure there is no unauthorised or harmful depositing, treatment or disposal of waste. These were amended but not superseded by the Environmental Protection (Duty of Care) Regulations 2003 (SI 63), which allow waste collection authorities to serve notices on people required to keep written descriptions of waste and transfer notes, and to require them to produce such documents to the authority within a specified time.
The Pollution Prevention and Control (Scotland) Regulations 2012 (Ref 14.15)	These regulations which regulate emissions to air, land and water as well as considering issues such as noise, waste and energy efficiency.
National Planning Framework 3 2014 (NPF) (Ref 14.16)	The NPF sets out a long-term vision for development and investment across Scotland over the next 20 to 30 years. It brings together plans and strategies in economic development, regeneration, energy, environment, climate change, transport and digital infrastructure to provide a coherent vision of how Scotland should evolve over the next 20 to 30 years.
The Waste (Scotland) Regulations 2012 (Ref 14.17)	Requires businesses to segregate materials such as glass, metal, plastics, paper and card for recycling.
Choosing our future: Scotland's sustainable development strategy 2005 (Ref 14.18)	This sets out actions to turn the shared priorities set out in the UK Framework for sustainable development into action.
Planning and Waste Management Advice 2015 (Ref 14.19)	The purpose of this document is to provide advice to planning authorities on a becoming a low carbon place and 'circular economy' as an alternative to the 'make, use, dispose' culture which means re-using products and materials continually and growing a low carbon economy
Scottish Government Zero Waste Plan, 2010 (Ref 14.20)	This sets out a vision of a zero waste Scotland where waste is treated as a valuable resource and proposes a long-term target of recycling 70% of Scotland's waste.
Scottish Government Scottish Planning Policy, 2014 (Ref 14.21)	This sets out national planning policies which reflect Scottish Ministers' priorities for operation of the planning system and for the development and use of land.
Scottish Government Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013-2027, 2013 (Ref 14.22)	This sets out how Scotland can deliver its statutory annual targets for reductions in greenhouse gas emissions for the period 2013–2027 set through the Climate Change (Scotland) Act 2009.

Legislative / policy	Description
Scottish Government Making Things Last: A Circular Economy Strategy for Scotland, 2016 (Ref 14.23)	This sets out our priorities for moving towards a more circular economy where products and materials are kept in high value use for as long as possible. It builds on Scotland's progress in the zero waste and resource efficiency agendas.
SEPA Land Remediation and Waste Management Guidelines, 2009 (Ref 14.24)	These set out SEPA's approach to regulating the remediation of contaminated sites under the waste regulatory regime.
SEPA Promoting the Sustainable Reuse of Greenfield Soils in Construction, 2010 (Ref 14.25)	This guidance fulfils a commitment made by SEPA under its Better Waste Regulation Action Programme 1 to encourage quality uses of soil.
SEPA Guidance on the Production of Fully Recovered Asphalt Road Planings (Ref 14.26)	This guidance promotes the sustainable reuse of asphalt road planings. It provides an agreed methodology for demonstrating when aggregate produced from source segregated asphalt road planings has been fully recovered to the extent that it has ceased to be waste for a particular proposed use.
SEPA Guidance on Recycled Aggregates from Inert Waste (Ref 14.27)	The purpose of this guidance is to clarify the point at which recycled aggregates manufactured from inert waste, in SEPA's view, cease to be waste and waste management controls are no longer required.
Waste Management Licensing (Scotland) Regulations 2011 (Ref 14.28)	This details how waste is managed within Scotland and includes controlled activities, public registers, registration of brokers and dealers, controlled activities, exemptions from waste management licensing, mobile plant, and revocation and consequential amendments.
Waste Management Licensing (Scotland) Amendment Regulations 2016, (Ref 14.29)	This document amends Schedule 1 to the 2011 Regulations which provides for activities which are exempt from the requirement to have a waste management licence.
The Special Waste (Scotland) Regulations 1996, (Ref 14.30)	This document defines special waste and details what consignment notes are, e.g. procedures, duty of care, duties of consignee and of the agencies as well as registers, site records, offences and the restrictions on mixing special waste.
The Special Waste Amendment (Scotland) Regulations 2004 (Ref 14.31)	This defines special waste, what it may comprise, how it is labelled, registers of producers and the duty of care responsibilities. It also sets out an amendment of the Pollution Prevention and Control (Scotland) Regulations 2000 with regards to special waste.
The Zero Waste Regulations (Scotland) 2012 (Ref 14.32)	The aim of the Zero Waste Regulations is to deliver key action points in the Zero Waste Plan. The regulations introduce a series of regulatory measures to assist with progress in achieving the aims of the waste hierarchy.
The Climate Change (Emissions Reduction Targets) (Scotland) Bill 2018	This bill amends the Climate Change (Scotland) Act 2009 and increases the emissions reduction targets up to 2050. In particular, it makes provision for the setting of a net zero emissions target by conferring powers on Scottish Ministers to specify the year for which a net zero emissions target will apply.
Local	
Aberdeenshire Local Development Plan (ALDP) 2017 (Ref 14.33)	Policy P1 Layout, siting and design states that developments will only be approved if they are, "efficient in terms of resources used in terms of waste management, water use, heating and electricity, the use of recycled materials and materials with low embodied energy and responding to local climatic factors associated with cold winds, rain, snow and solar gain".

14.3 Methodology

Defining the study area

14.3.1 The study area for this chapter was taken to be the scheme footprint and a construction working corridor (buffer zone) of 10m. A search of waste facilities and quarries within 30km of the scheme was also completed as this was considered to be within suitable distance of the scheme to facilitate the materials and waste requirements. As IAN 153/11 does not dictate buffer zones or study area guidelines, professional judgement was applied to determine suitable areas based on the nature and scale of the scheme.

Determining the baseline

Desk top study

14.3.2 Information was obtained through a desk top search of readily available information from the Scottish Environmental Protection Agency's (SEPA) Waste Site Information website (Ref 14.34), Google Maps (Ref 14.35) and discussions with the project designer. Further information on the sources used can be found within Chapter 18 References, Materials and waste section.

14.3.3 Additionally, previously published reports and ground investigations regarding the scheme and its vicinity have been reviewed along with previous site walkover information. The reports reviewed are as follows:

- Access to Laurencekirk STAG Report, CH2MHILL, June 2015 (Ref 14.36); and
- A90 (T) Laurencekirk Junctions, NESTRANS, October 2012 (Ref 14.37).

Assessment method

14.3.4 The assessment has been undertaken in accordance with the guidance set out in DMRB Volume 11, Section 3 Environmental Assessment, in conjunction with IAN 153/11 Guidance on the Environmental Assessment of Material Resources and draft guidance HD 212/11 Materials.

14.3.5 The sensitivity of materials has also been assessed in accordance with the guidance set out in Table 2.1 of DMRB Volume 11, Section 2, Part 5, Assessment and Management of Environmental Effects, Chapter 2 Determining the significance of environmental effects in conjunction with IAN 153/11.

14.3.6 IAN 153/11 recommends a Detailed Assessment of the environmental consequences of the scheme to inform project decisions. A Detailed Assessment is a quantitative assessment identifying the significant effects of a scheme. It uses the data gathered at the Simple Assessment level, collates information to quantify the materials required and forecasts the quantity and types of wastes which will be produced.

14.3.7 The environmental impacts (indirect) or effects of material resources can also be assessed through calculation of the embodied carbon dioxide associated with specific materials or construction products. HD 212/11 recommends the consumption of materials is assessed to assign embodied carbon dioxide equivalent (CO2e) per unit of material used (i.e. tonnes of carbon dioxide (CO2) per tonne, or per cubic metre (or similar) of material). Transport Scotland's carbon calculator tool, known as the Carbon Management System project carbon tool (CMS) has been used for this scheme.

14.3.8 It is acknowledged in IAN 153/11 that the extraction and transport stages of a materials lifecycle would already have been subject to an environmental assessment. Instead the assessment concentrates on the impacts that would occur as a result of the use of primary, secondary and recycled raw materials and manufactured construction products on the project.

14.3.9 Instead the assessment concentrates on the impacts that would occur as a result of the use of primary, secondary and recycled raw materials and manufactured construction products on the project. However, it should be noted that the environmental credentials for any materials consumed by the scheme, for example the carbon footprint and sustainability statistics, shall be taken into consideration by the contractor when evaluating their choice.

14.3.10 The materials assessment has been undertaken using professional judgement and guidance from DMRB (see paragraph 14.3.5). The assessment criteria used for assessing environmental sensitivity, environmental impacts and typical descriptors is described below. The draft Materials guidance states "*the detailed level of assessment is based on quantifying the magnitude of change associated with a project's material requirements in absolute terms. The magnitude of the impact is assigned though the use of a proxy in the shape of the embodied carbon emissions associated with specific materials or construction products…. The magnitude of the impact, and hence the scale, can be ranked without regard to the value of a resource/receptor. Although the scale of the magnitude is not strictly a measure of the significance….it provides an indication of the severity or otherwise or identified impacts*".

Method for assessing the importance/ sensitivity of resource

14.3.11 The value/sensitivity of each resource is assessed using the criteria provided in Table 14-2.

Table 14-2: Criteria for assessing importance/ sensitivity of a receptor

Importance/ sensitivity of resource or receptor	Criteria
Very High	Very high scarcity of required material resource. There is no available waste management infrastructure capacity within the study area for any waste arisings from the scheme. Very high importance and rarity, national scale. Very limited materials reuse, recycling and or recovery. No capacity of existing highways network to accommodate any increases in lorry movements resulting from the flow of material resources and wastes to and from the scheme.
High	High scarcity of required material resource. There is limited waste management infrastructure capacity within the study area in relation to the forecast waste arisings from the scheme. High importance and rarity, regional scale. Limited materials reuse, recycling and or recovery. Low capacity of existing highways network to accommodate any increases in lorry movements resulting from the flow of material resources and wastes to and from the scheme.
Medium	Medium scarcity of required material resource. There is adequate waste management infrastructure capacity within the study area for the majority of waste arisings from the scheme. High or medium importance and rarity, regional scale. Moderate materials reuse, recycling and or recovery. Medium capacity of existing highways network to accommodate any increases in lorry movements resulting from the flow of material resources and wastes to and from the scheme.
Low	Low scarcity of required material resource. There is adequate available waste management infrastructure capacity within the study area for all waste arising from the scheme. Low or medium importance and rarity, local scale. High materials reuse, recycling and or recovery. High capacity of existing highways network to accommodate any increases in lorry movements resulting from the flow of material resources and wastes to and from the scheme.
Negligible	Negligible scarcity of required material resource. There is waste management infrastructure capacity within the study area for all waste arisings from the scheme. Negligible importance and rarity, local scale. Very high materials reuse, recycling and or recovery. Very high capacity of existing highways network to accommodate any increases in lorry movements resulting from the flow of material resources and wastes to and from the scheme.

Method for assessing the magnitude of impact

14.3.12 The assessment takes into account the quantities of materials required and the quantities of waste arising (during site preparation and construction) for the scheme from the following;

- Earthworks estimates (total cut and fill volumes) including the installation of attenuation basins
- Estimated quantities of required construction materials for all road structures
- Potential for encountering and handling contaminated wastes
- Estimated areas of vegetation clearance required.

14.3.13 The magnitude of each impact is assessed using the criteria provided in Table 14-3.

Table 14-3 Assessment criteria for magnitude of impact

Magnitude of impact	Criteria
Major	Loss of natural resources and or quality and integrity of natural resources; severe damage to key characteristics, features or elements. Waste arisings from the scheme are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation. Generation of large quantities of hazardous, non-hazardous and inert waste which are managed for disposal using methods lower down the waste hierarchy (e.g. landfill or incineration with energy recovery).
Moderate	Loss of natural resources, but not adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements. Waste arisings from the scheme are predominantly disposed of by incineration with energy recovery. Generation of moderate quantities of hazardous and inert waste which are managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Waste arisings from the scheme are predominantly segregated and sent for composting, recycling or for further segregation and sorting at a materials recovery facility. Generation of small quantities of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements. Waste arisings from the scheme are predominantly reused on site or at an appropriately licensed or registered exempt site elsewhere. Generation of negligible quantities of hazardous and inert waste which are managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery).

Magnitude of impact	Criteria
No Change	No loss or alteration of characteristics features or elements; no observable impact in either direction. All waste arisings from the scheme are reused on site or at an appropriately licensed or registered exempt site elsewhere. No generation of hazardous waste. All inert materials reused onsite.

14.3.14 The nature of each impact is classified as being:

- Adverse – Detrimental or negative impact to an environmental resource or receptor; or
- Beneficial – Advantageous or positive impact to an environmental resource or receptor

14.3.15 The scale of the indirect impact magnitude on materials through embodied carbon is classified according to Table 4.4 within DMRB HD212/11. This is reproduced here as Table 14-4.

Table 14-4: Scale of impact magnitude for materials

Scale of impact magnitude	Total CO2e 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

14.3.16 Draft HD 212/11 does not define sensitivity or significance for material consumption and use and states that in the absence of a true measure of significance, therefore impact magnitude provides an indication of the severity or otherwise of the identified impacts.

Method for assessing the significance of effect

14.3.17 The assessment of significance is based on the characteristics of the impact and the sensitivity of the receptor. By establishing the sensitivity / value of the receptor and the magnitude / nature of the impact, the table below is used to determine the significance level of the environmental effect. The significance of each effect is assessed using the criteria provided in Table 14.5. Table 14-6 details typical descriptors for each significance classification.

Table 14-5: Assessment criteria for significance of effect

Sensitivity of the receptor	Magnitude of impact				
	Major	**Moderate**	**Minor**	**Negligible**	**No Change**
Very high	Very Large	Large or Very Large	Moderate or Large	Slight	Neutral
High	Large or Very large	Moderate or large	Slight or Moderate	Slight	Neutral
Medium	Moderate or Large	Moderate	Slight	Neutral or Slight	Neutral
Low	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight	Neutral
Negligible	Slight	Neutral or Slight	Neutral or Slight	Neutral	Neutral

Table 14-6: Descriptors of Effect Significance

Significance	Definitions
Very Large	Significant change in environmental conditions. Impacts are likely to be of a very high magnitude and frequency and will impact on the existing strategy to deal with material resources and waste. Impact likely to be on a permanent basis.
Large	Considerable change in environmental conditions. Impacts are likely to be of a high magnitude and frequency and will have an effect on the existing strategy to deal with material resources and waste. Impact likely to be on a permanent basis.
Moderate	Noticeable change in environmental conditions. Impacts are likely to be of a high magnitude and frequency and will have an effect on the existing strategy to deal with material resources and waste. Impact likely to be on a permanent basis
Slight	Barely perceptible change in environmental conditions. Impacts are likely to be of a low magnitude and frequency and will have an effect on the existing strategy to deal with material resources and waste. Impact likely to be on a temporary basis
Neutral	No discernible change in environmental conditions. Impacts are likely to be of a negligible magnitude and frequency and will not have an effect on the existing strategy to deal with material resources and waste. No impact.

14.4 Baseline Conditions

Current materials within the study area

14.4.1 The current A90 within the study area comprises a dual carriageway with DMRB standard road markings and road studs. There are no street lights illuminating the route or the junctions. Road drainage throughout the A90 study area is provided by top and side entry road gullies.

14.4.2 The Laurencekirk central junction is approximately 1.6km south of the north junction and is approximately 30.7m wide. The northbound carriageway is bounded by approximately 6.0m of grass verge with visible filter drainage. A wire fence separates the verge, and an additional 4.0m

of flat grassland. Beyond the grass is a stone wall which bounds Laurencekirk Cemetery. The grass verge is reduced to 1.0m at the corners of the junction where a wire fence separates the A90 and agricultural land. The north and southbound carriageways are separated by a central reservation of approximately 4.0m to 9.0m and tapers at the priority junction that allows the crossing of the A90 from the B9120. A vehicle restraint system (VRS) is situated within the central reservation. A physical island with a width of approximately 9.0m in width and 22.0m in length aids the crossing of the A90 at the staggered junction. The southbound carriageway is bounded by an approximate 4.0m flat grass verge and a wire fence. Frain Drive crosses the A90 via an underbridge approximately 360m south west of the central junction.

14.4.3 The Laurencekirk southern junction is approximately 1.6km south of the central junction and is approximately 31m wide at this point. The northbound carriageway is bounded by approximately 7.0m of flat grass verge with a VRS at 0.5m from the carriageway at parts. A deceleration lane gives access to Laurencekirk to the west. The northbound and southbound carriageways are separated by a central reservation of approximately 4.0m with a VRS installed. The southbound carriageway to the north of the junction is bounded by approximately 4.0m of flat grass verge with filter drainage. The southbound carriageway to the south of the junction is bounded by approximately 4.0m of flat grass verge with filter drainage. There is a wire fence and occasional trees that separate the verge from flat agricultural farm land. Johnston Lodge access lies approximately 390m north east of the southern junction, off the southbound carriageway.

Primary Aggregate Resources in the Study Area

14.4.4 There are a number of active quarries within 30km of the scheme:

- Craiglash Quarry is located c. 29km NE of the scheme and produces igneous and metamorphic rock. The quarry is licenced to extract until 2021; in 2010 an application to extend the operation by 15 years was lodged however planning was only granted until March 2021. As the assumed year of construction is 2022 the quarry will only be capable of supplying the scheme should further extension be granted.
- Nether Park Quarry is located c.25km N of the scheme and produces sand and gravel. The quarry is licenced for extraction until 2026 and so is available as a source of materials for the scheme.
- Cammie Wood Quarry is located c.20km N of the scheme and produces sand and gravel. The date of expiration of the licence for this quarry is unknown.
- Park Quarry is located c.26km NE of the scheme and produces sand and gravel. The quarry is licenced to extract until 2022.
- Breedon Group own two quarries: Edzell Quarry is located c.9km west of the scheme and produces sand and gravel, aggregates and ready-mix concrete. Capo Quarry is

located just east of Edzell quarry and also produces aggregates and ready-mix concretes. It is unknown when the quarries are licenced to extract until however, they have significant mineral reserves and are currently active.

- Hatton Mill Quarry is located c.21km SW (Angus Council) and produces sand and gravel. The quarry is licenced to extract until 2023 and so is available as a source of materials for the scheme.
- Walkmill Quarry is located c.22km SW (Angus Council) and produces hard rock. The quarry is licenced to extract until 2027 and so will be available as a source for the scheme materials. Additionally, to this, the quarry extended in 2013 and now produces asphalt and macadam products.

14.4.5 Chapter 13, Geology and Soils provides detailed information on the geology beneath the scheme. The Aberdeenshire Local Development Plan indicates that there are no mineral safeguarding sites within the proposed scheme extents.

Current utilities

14.4.6 Public utilities are present within the scheme (Fig 14.1) however, as any service diversions will be the responsibility of the contractor, it is assumed that where necessary any services directly affected by the realignment will be relocated as part of the scheme. Therefore, public utilities have been scoped out of further assessment.

Waste management

14.4.7 Waste is considered to be surplus materials generated which cannot be re-used onsite (earth, surplus manufactured construction materials, surplus raw materials). The key principle of waste management follows the waste hierarchy, which promotes selection of the Best Practical Environmental Option (BPEO) for management of wastes. The BPEO form part of a waste hierarchy which comprises the following:

- Prevention: prevent waste being generated, e.g. altering the design to reduce the amount of excavation required;
- Reuse: reuse materials rather than disposal, e.g. reuse excavated materials as fill or as landscaping;
- Recycle: if material cannot be reused on site, it may be recycled for other uses off site, e.g. waste can be segregated into wood, metal, or concrete that can be removed off site processed and used again;
- Recovery: waste that cannot be recycled or reused must be disposed of in an appropriate manner. Some combustible materials may be sent to an energy recovery

incinerator, composter or bio-digester. These methods enable electricity or compost to be generated from waste; and/or

- Disposal: if none of the above methods are appropriate, then waste must be disposed of to an appropriately licensed landfill site.

14.4.8 The disposal of waste materials can be assessed in terms of where and how they can be disposed and the associated impact of this disposal. Materials which may be classified as waste include the following:

- Excavated arisings, construction and demolition materials which are not suitable for reuse as they do not meet the required specification;
- Excavated material classified as hazardous waste due to the presence of contaminants;
- Waste products arising from the presence of construction staff on site e.g. effluent from portable toilets, food waste and packaging; and
- Waste from surplus materials and spillages.

14.4.9 There is insufficient information at present to accurately forecast waste streams that would be produced on the site; however predicted waste will be construction and demolition waste (including soils and stones) and manufactured construction materials such as mixed metals and timber. Therefore, local landfill and waste facility capacity as a whole has been reviewed. Information from SEPA on the nearest active landfill sites, is summarised in Table 14-7 and shown in Figure 14.2. These landfill sites have the capacity to deal with scheme waste. There are no waste treatment facilities other than landfill within the study area.

Table 14-7: Nearest waste infrastructure

Ref. no.	License number	Name of site	Capacity (tonnes)	Distance from the A90	Type of site
1	PPC/A/1008926	Bolshan Quarry landfill, Friockheim	135,000	19.6 km south	Inert
2	PPC/A/1009964	Hatton Mill Landfill site	1,875,270	22.4 km south	Inert
3	PPC/A/1008876	Border Quarry Landfill, Friockheim	129,810	22.3 km south	Inert
4	PPC/A/1008856	Park Quarry, South Deeside Road, Aberdeen	Not known; estimated to cease 2020.	29.3 km north	Inert
5	PPC/A/1000120	Restenneth Landfill Site, Forfar DD8 2RN	3,240,000	29.3 km south	Non-hazardous
6	PPC/A/1008879	Pettycur Landfill Site	Annual capacity of 24,999	10 km south	Inert

Ref. no.	License number	Name of site	Capacity (tonnes)	Distance from the A90	Type of site
7	PPC/E/0020086	Avondale Hazardous Landfill Site*, Avondale Road, Falkirk FK2 OYA	800,000	119 km south west	Hazardous
Note: * there are no hazardous landfill sites within 30km of the scheme. Avondale hazardous landfill site is the closest one to the scheme and the only one in Scotland.					

Construction Materials

14.4.10 Based upon the design for the scheme, the projected quantities of material likely to be required is summarised in Table 14-8.

Table 14-8: Material quantities

Construction stage	Material	Unit	Quantity
Earthworks	Class 2A materials	m^3	300472
	Class 6F (inc. capping material)	m^3	9173
	acceptable material in embankments and other areas of fill (reused)	m^3	16249
	acceptable material in landscape areas (reused)	m^3	12002
Fencing	timber	m	5884
	steel	m	19
	RRS / safety barrier	m	4900
	RRS / safety barrier terminals	no.	16
Drainage	Pre-cast concrete chambers	no.	140
	Gullies (iron and brick)	no.	265
	Headwall (precast concreate)	no.	44
	UPVC Drains	m	2234
	Filter drains (class 8 material)	m^2	5878
Pavements	sub-base	m^3	9322
	surfacing, binder and base (inc material for Pavements below)	m^2	104441
	Regulating course - Asphalt and aggregates	T	600
	Kerb	m	5989
	Drop Kerb	no.	24
	Tactile paving	No.	165
Road signs	Lines	m	18591

Construction stage	Material	Unit	Quantity
	Chevrons	no.	542
	Green surface paint for 3m cycle lane	m^2	192
	Road studs	no.	1624
	Signs	no.	25
Lighting	10m aluminium lamp posts	no.	59
	LEDs	no.	84
	LED Bollards	no.	4

14.4.11 Projected quantities of waste are provided in Table 14-9. It is also expected that there will be small quantities of hazardous waste produced during the works. This may include but is not limited to paints and solvents, admixtures, spill absorbent materials, waste lubricants, oil filters, waste electrical and electronic equipment, batteries and fluorescent light tubes.

Table 14-9 Waste quantities

Waste		Unit	Quantity
Earthworks	General Site Clearance	ha	20
	Disposal of acceptable material Class 5A (topsoil).	m^3	12646
Paving	Milling pavement	m^2	7581

14.5 Impact Assessment

14.5.1 The predicted environmental impacts for the scheme have been assessed exclusive of mitigation measures and the residual effects have then been assessed following the application of mitigation. Table 14.10 details the impacts associated with materials and waste associated with the scheme.

Embodied Carbon

14.5.2 An assessment of potential embodied carbon impacts associated with the scheme was undertaken using Transport Scotland's CMS in line with the requirements of draft HD 212/11 detailed assessment. Total embodied carbon was estimated based on the indicative consumption of materials associated with the design quantities for the scheme.

14.5.3 The material quantities for construction of the scheme were entered into the CMS, which calculates the CO2e of each of the materials. The tool can also be used to quantitatively estimate which principal components of the proposed scheme are likely to have a greater carbon footprint in terms of materials required.

14.5.4 The Transport Scotland CMS calculated carbon emissions can be found in Table 14-10 and have been used to aid the assessment of the potential impacts associated with materials use on the scheme. The calculation has only been completed for materials for which at this stage quantities (volume) are known. It can be assumed that other construction materials required such as concrete culverts, metals, woods and plastics will increase the total carbon for the scheme; this however is not expected to increase the magnitude of impact enough to result in a significant effect.

Table 14-10: Summary of material volume and embodied carbon emissions

Project element	Material resource	Unit	Approximate estimated material quantity*	Embodied carbon emissions (tC02e) – Primary materials use	Embodied carbon emissions (tC02e) – Worst case scenario (15% contingency)
Bulk earthworks	Imported materials	m^3	14359	0	0
Road pavement	Asphalt	m^3	846	123	142
Civil engineering structures	ST2 Concrete fencing foundations	m^3	118	227	31
Total				350	173

Assessment of Impacts on Materials and Waste

14.5.5 Table 14-11 details the potential impacts associated with materials and waste and incorporates embodied carbon in the assessment.

Table 14-11: Materials and waste impact assessment

Receptor	Sensitivity	Project activity	Predicted Impact	Magnitude of impact
Materials	Low; materials are assessed as having low sensitivity as materials required for the scheme are of low importance and rarity and are available at local scale.	Construction	<u>Use of Materials: aggregates & manufactured construction products:</u> • 16249m^3 cut, acceptable material will be re-used in embankments and other areas of fill. • A deficit of 300472m^3 exists requiring imported fill • Scheme requires aggregates (sub-base) and asphalt for surfacing. • Scheme requires manufactured construction material such as concretes, plastics and metals (Table 14-8)	Moderate adverse: large quantity of fill material is required however there is significant resource capacity in the study area to provide the materials. **Significance: Slight**
		Construction	<u>Embodied Carbon:</u> • Quantifiable materials have been assessed as having a tC02e value of 173 (with 15% contingency); although additional materials are expected to increase the embodied carbon it is not expected to exceed the thresholds in • Table 14-4 to cause a significant effect.	No Change; total predicted embodied carbon for materials does not exceed 1000 tonne. **Significance: Neutral**
Waste	Low; waste facilities have been assessed as having low sensitivity as there is ample capacity for waste generated by the scheme, in the study area.	Pre-construction & Demolition	<u>Demand on the capacity of waste handling and disposal facilities:</u> • Maximum amount of pavement removal required is 7581m^2 which will require disposal to a waste facility. • Maximum vegetation clearance required is 19.63 ha, some of which has potential to be re-used on site. • Maximum amount of unsuitable material requiring disposal to waste facility is 12646 m^3	Moderate permanent adverse impact anticipated due to the quantities of waste which require disposal to waste facility. **Significance: Slight**
		Construction	• Minimal excess of manufactured construction materials such as concretes, mixed metals, paints etc. This waste will not require disposal to landfill; it will be sent to a reclamation centre or maintained by the contractor/client for future schemes.	Negligible impact; minimal quantities requiring disposal to waste facility. **Significance: Neutral**

14.6 Impacts on Policy and Legislation

14.6.1 Following the assessment of impact, the scheme has been assessed against the various relevant policies. The results are shown in Table 14-12.

Table 14-12: Impacts on policies and legislation

Legislative Instrument	Relevance to the scheme assessment	Achieves objectives
International		
The Waste Management Directive 2006/12/FC	The production of a SWMP is recommended to ensure that the waste produced on site will be reused and recycled rather than disposed of.	Yes
Waste Framework Directive 2008/98/EC		
National		
Environmental Protection Act 1990	The production of a SWMP would ensure that all legal responsibilities for the duty of care of waste, contaminated land and statutory nuisance are met.	Yes
The Environment Act 1995		
The Control of Pollution Act 1974 and Amendment 1989		
The Environmental Protection (Duty of Care) Regulations 1991 (SI 2839)		
The Pollution Prevention and Control (Scotland) Regulations 2012		
National Planning Framework 3 2014	The production of a SWMP is recommended so that waste produced on site can be segregated and appropriately managed, using the waste hierarchy to reduce the volume of imported material transported to the area.	Yes
The Waste (Scotland) Regulations 2012		
Choosing our future: Scotland's sustainable development strategy 2005		
Planning and Waste Management Advice 2015 Planning Advice Note (PAN) 63 Waste Management Planning		
Scottish Government Zero Waste Plan, 2010		
Scottish Government Scottish Planning Policy, 2014 (Ref 14.20)		
Scottish Government Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013-2027, 2013 (Ref 14.21)		
Scottish Government Making Things Last: A Circular Economy Strategy for Scotland, 2016		
The Climate Change (Emissions Reduction Targets) (Scotland) Bill 2018	Use of local products and incorporation of recycled materials will contribute to reduced carbon emissions	Yes
SEPA Land Remediation and Waste Management Guidelines, 2009	The production of a SWMP is recommended so that waste produced on site can be segregated and appropriately managed, using the waste hierarchy to reduce the	Yes
SEPA Promoting the Sustainable Reuse of Greenfield Soils in Construction, 2010		
SEPA Guidance on the Production of Fully Recovered Asphalt Road Planings		

Legislative Instrument	Relevance to the scheme assessment	Achieves objectives
SEPA Guidance on Recycled Aggregates from Inert Waste	volume of imported material transported to the area.	
Waste Management Licensing (Scotland) Regulations 2011		
Waste Management Licensing (Scotland) Amendment Regulations 2016		
The Special Waste (Scotland) Regulations 1996		
The Special Waste Amendment (Scotland) Regulations 2004		
The Waste (Scotland) Regulations 2012		
Local		
Aberdeenshire Local Development Plan (ALDP) 2017	On site materials will be reused within the scheme	Yes

Summary of impacts

Materials

14.6.2 Table 14.11 indicates that there will be an overall impact on material resources of moderate as a result of the scheme.

Waste

14.6.3 Table 14.11 indicates that the scheme will have a moderate adverse impact due to the quantity of waste which must be disposed of from site.

14.7 Mitigation Measures

14.7.1 As with every construction project, best practice will be followed at all times to reduce wastage and reduce the quantity of raw materials needed to construct and maintain the project. Methods that will be considered are discussed below.

14.7.2 One of the main ways to reduce the impact on materials is to reuse excavated material on site and reduce the requirement for virgin materials. The Scottish Government encourages materials reuse through, for example, the Scottish Government Zero Waste Plan which provides construction principles for designing out waste.

14.7.3 Throughout the construction of the scheme, it is recommended that recycling and reuse policies be followed wherever possible, in order to reduce wastage and minimise surplus materials. Waste streams should be segregated and stored appropriately. Disposal of waste will follow duty of care protocols and waste will be removed off site by licensed waste carriers.

Preconstruction and Demolition

14.7.4 The following mitigation measures will be adhered to:

- A Site Waste Management Plan (SWMP), a Materials Management Plan (MMP) and a Soils Resource Plan (SRP), must be implemented and should ensure the reuse of excavated materials is be maximised, reducing volume of virgin materials required by the scheme. These will form part of a Construction Environmental Management Plan.
- It is acknowledged that not all cut material would be suitable for reuse. It is likely that approximately 60% to 70% of material would be suitable for reuse on site (BREEAM target rates for diversion from landfill within Waste 01 construction waste management guidance (Ref 14.38) and the Scottish Government Zero Waste Plan, subject to regulatory authorisations. The scheme will aim to achieve a 60% reuse rate.
- Any vegetation removal should be mulched, subject to regulatory permissions and approval, and used within new landscape areas.
- Topsoil stripped during site clearance and initial ground preparation would be stored and reused on verges and embankments however, additional topsoil will be required. Excavated subsoils and topsoil would be stored separately and stockpiled appropriately to ensure they are suitable for reuse. Discussions will be undertaken with SEPA regarding storage requirements and registration of any exemptions required.

14.7.5 To maximise the reuse of existing materials on site, consideration will be given to recycling road planings and use as aggregates in the sub-base layers. This would be subject to agreement and appropriate registration with the SEPA prior to work commencing. Recycled aggregates can be sourced for road construction to reduce costs and improve sustainability of the scheme. SEPA has provided guidance in documents 'Guidance on the production of fully recovered asphalt road planings' (Ref 14.39) and 'Recycled Aggregates from Inert Waste' (Ref 14.40).

Site construction

14.7.6 The following measures should be implemented through the construction phase:

- Use of locally sourced materials and ordering materials only as and when required, can reduce the amount of excess materials wastage and reduce transport costs and carbon footprint.
- Where appropriate, current signage may be recycled to reduce the amount of new signage required. This is also an opportunity to install passive safety sign installations.

14.7.7 The SWMP, MMP and SMP should be adhered to: to ensure segregation, recycling and reuse to ensure duty of care protocols are complied with and that waste disposal is undertaken by licensed waste carriers. The SWMP and MMP will form part of an overall site Construction Environmental Management Plan (CEMP). This is a live document which would detail environmental control measures such as licenses, mitigation measures and may contain several individual plans such as noise plans, pollution prevention plans, the SWMP, and MMP. The

CEMP will also define the roles of Environmental Site Manager and/or Environmental Clerk of Works who will be responsible for the monitoring and management of the mitigation measures.

Summary of mitigation

14.7.8 Mitigation measures are summarised in Table 14-13.

Table 14-13: Mitigation measures reporting matrix

Project Activity	Potential impacts associated with material resource use/ waste management	Description of mitigation measures	How the measures will be implemented, measured and monitored
Site preparation/ demolition	Disposal of site clearance Disposal of excavation waste	Reuse of excavated site won material within the scheme Materials sourced locally from primary aggregate sources	Will be carried through in contactor SWMP, MMP and SRP. The principle contractor will be responsible for ensuring implementation.
Site construction	Depletion of natural resources Disposal of surplus construction materials and waste	Reuse of materials Minimise storage time of materials and waste Waste management on site	Will be carried through in contactor SWMP, MMP and SRP. The principle contractor will be responsible for ensuring implementation.

14.8 Residual Effects

14.8.1 Whilst implementation of the above mitigation measures and best practice will reduce waste and use of raw materials, some waste will be produced as a result of:

- Wastage through spillage of materials;
- Wastage through transport of materials; and
- Materials which are unsuitable for reuse or recycling.

14.8.2 Table 14-14 summarises the residual effects on material resources and waste as a result of the scheme. Residual effects are of slight significance.

Table 14-14 Summary of Residual Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Potential Mitigation Measures	Residual Impact Magnitude	Significance of effect
Material Resources – The scheme will require substantial volumes of finite material resources	Low	Moderate	Reuse/recycle site won materials to reduce the volume of imported materials required. Use of mulched vegetation and excavated material within new landscape areas.	Minor	Slight
Waste Infrastructure – The scheme will contribute to finite landfill space within both inert and hazardous landfill sites	Low	Moderate	Adherence of construction best practices to reduce waste production. Reuse of site won materials (excavated material/vegetation cuttings/road planings/road signage) Use of recycled aggregates to improve scheme sustainability.	Minor	Slight

14.9 Limitations

14.9.1 The utility information was obtained in December 2016 and prior to any site works it is recommended that an updated utility assessment is undertaken.

14.9.2 A further limiting factor is that there is limited information at this stage regarding the following:

- Principal Contractor's design and procurement decisions, particularly those involving the selection of construction materials, products and additives.
- The precise geographical sources of imported materials; whether they are from virgin or from recycled or secondary sources, incorporate recycled or secondary content, are from sources with existing recognised responsible sourcing certification.
- Whether any site-won materials or imported materials from recycled or secondary sources are regulated as "Waste" under the Pollution Prevention & Control (Scotland) Regulations or Waste Management Licensing Regulations
- The chosen waste management methods (recycling, recovery, disposal) and precise geographical locations for managing each waste stream that cannot be re-used on-site.

14.9.3 This chapter, and all waste and recycling assessments, is based on the current reference design and assumes that the scheme will be developed in accordance with this information. Whilst considered sufficient to inform the assessment, initial quantifications of the material resources

use and waste arisings forecast from the scheme have been derived from the reference design information.

14.10 Conclusions

14.10.1 The scheme would result in the permanent use of materials to construct the grade separated junction. Reusing existing materials where possible and sourcing recycled materials for construction would increase the sustainability of the project, though the cut / fill balance indicates that a large volume of materials will need to be imported to construct the scheme.

14.10.2 Whilst the majority of materials will be reused on site to minimise the volume of imported materials, it is anticipated that some material will require disposal to a suitably licenced landfill. The main sources of waste likely to require off-site disposal comprise soils that cannot be reused on site due to engineering constraints.

14.10.3 The scheme would result in slight significant adverse effects on materials and waste.