A9 Dualling Dalraddy to Slochd

Stage 2 Scheme Assessment Report Volume 1 – (Part 1 & 2)

August 2016

TRANSPORT SCOTLAND

ATKINS mouchel

Notice

This document and its contents have been prepared and are intended solely for Transport Scotland's information and use in relation to A9 Dualling Northern Section (Dalraddy to Inverness).

AtkinsMouchel assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 176 pages including the cover.

Document history

Document ref: A9P11-AMJ-HGN-Z_ZZZZZ_ZZ-RP-ZZ-0001				**Suitability**: For Review and Comment		
Revision	Purpose description	Originated	Checked	Approved	Authorised	Date
P01	1st Draft	GL	MD	CMcC	RHG	09/08/16
P02	Final Draft	GL	MJD	CMcC	DH	10/10/16
P03	Final Draft 2nd issue	GL	MJD	CMcC	RHG/DH	05/12/16
P04	Final Issue	GL	IA/MJD	CMcC	RHG/DH	24/02/17

Client signoff

Client	Transport Scotland
Project	A9 Dalraddy to Slochd
Document title	DMRB Stage 2 Report
Document reference	A9P11-AMJ-HGN-Z_ZZZZZ_ZZ-RP-ZZ-0001

Stage 2 Report – Overall Structure

- Volume 1 – Main Report and Appendices
- Volume 2 – Engineering Figures
- Volume 3 – Environmental Figures

Table of contents

Glossary of Terms

1 in 200 year event		A flood that has a 0.5% (1 in 200) or greater chance of happening each year.
A' weighting dB(A)		The human ear does not respond uniformly to different frequencies. A-weighting is commonly used to simulate the frequency response of the ear.
Above Ordnance Datum	**AOD**	The mean sea level at Newlyn (UK) used as a base measurement on Ordnance Survey Maps for contours.
Abutment		A structure that supports the end of the bridge or supports the bridge approach.
Acid grassland		Grassland that occurs on acidic soils (pH less than 5.5).
Acoustics		The study of sound, especially its generation, transmission and reception.
Air Quality Management Area	**AQMA**	An area where the National Air Quality Strategy objectives are not likely to be achieved in all relevant locations. AQMAs are designated by local authorities following a review and assessment process.
Air Quality Strategy	**AQS**	Sets out air quality objectives and policy options to further improve air quality.
Alien species		A species that exists outside of its normal distribution.
Allocation		A proposal for land for housing, industry or other uses within a Local Plan / Local Development Plan that identifies a specific area of land to be developed within the time period of the plan.
Alluvium		Sediment deposited by a river.
Amber list species		Bird populations in moderate decline or previously in severe decline but are recovering.
Amenity grassland		Intensively managed and regularly mown grasslands. These areas are typically of low diversity and limited wildlife and landscape value.
Amenity value		Defined as the relative pleasantness of a journey and relates in particular to the exposure of pedestrians and others to traffic.
Ancient Woodland Inventory	**AWI**	Aims to list all probable ancient semi-natural woodlands on a county basis together with those woodlands in other ancient categories of lesser woodland nature conservation interest.
Ancient Woodland		Land that is currently wooded and has been continually wooded, at least since 1750.
Annual Average Daily Traffic	**AADT**	Traffic flow expressed as 24 hour Annual Average Daily Traffic (AADT), that is the total annual traffic divided by 365.
Area of Great Landscape Value	**AGLV**	An area designated by a local authority in development plans as being of outstanding scenic quality and character and requiring special protection against inappropriate forms of development.
Area of Outstanding Landscape Quality	**AOLQ**	An area designated by a local authority as being of exceptional landscape quality and requiring special protection against inappropriate forms of development.
Appropriate assessment	**AA**	An assessment of likely impacts associated with a development on a European Protected Site. An Appropriate Assessment is required by law under Regulation 48 of the Habitats Regulations (1994), implementing Article 6(3) of the Habitats Directive (92/43/EEC).
Aquifer		A body of rock through which appreciable amounts of water can flow.
Arable land		Land that is or can be used for growing crops.

Archaeological watching brief		An archaeological watching brief is a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.
At-grade junction		A type of junction where there is no height (grade) difference or separation between the traffic carriageways of a junction, e.g. a roundabout or a T-junction is an at-grade junction.
Authority area		The area administered by a local authority.
Automatic Traffic Counter	**ATC**	Temporary and / or permanent traffic counters to capture traffic volume. Can also be set up to capture classification and speed of vehicles.
A9 Dualling Traffic Model	**A9DTM12**	S-Paramics microsimulation model covering the A9 from Inveralmond Roundabout to north of Daviot.
Bait-marking		A technique used for determining the territorial boundaries of badger social groups, involving the use of bait laced with coloured plastic pellets.
Balancing pond		Part of a Sustainable Urban Drainage System (SUDS). The purpose of the balancing pond is to contain the surge of water during/after a storm and release it slowly/in a controlled way, thus preventing flooding and potential pollution.
Bank toe reinforcement		Strengthening to the base of a river or stream bank to prevent erosion.
Baseline		The existing conditions which form the basis or start point of the environmental assessment.
Basic Noise Level	**BNL**	The baseline noise level at a reference distance of 10m away from the nearside carriageway edge, the calculation of which takes account of time period, vehicle flow, speed, % heavy vehicles, gradient and road surface.
Bedrock		Hard rock that lies beneath a superficial cover of soils and sediments.
Best Practicable Means	**BPM**	Defined in the Control of Pollution Act 1974 as measures which are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current stated of technical knowledge and to financial implications'.
Biodiversity		Biological diversity or species richness of living organisms present in representative communities and populations.
Biodiversity Action Plan	**BAP**	Sets objectives, along with measurable targets for the conservation of biodiversity.
Biodiversity Management Plan		Document identifying the actions to be taken to ensure the maintenance and long-term viability of priority species and habitats in a defined site or area, and the parties responsible for these actions.
Broadleaved woodland		An area of woodland with predominantly deciduous tree species (less than 10% coniferous trees in the canopy).
Brownfield		Industrial or commercial property or land that is abandoned or underused and often environmentally contaminated.
Bund		An embankment, wall or dam that can be used to minimise noise or alternatively built around an oil tank to contain the contents in the event of spillage.
Burn		A small stream.
Calculation of Road Traffic Noise	**CRTN**	Produced by the Department of the Environment and the Welsh Office in 1988 and provides the method of calculating (and measuring) road traffic noise levels for new and altered highways

Catalogue of Rights of Way	**CRoW**	A catalogue of all the known rights of way in Scotland compiled in the 1990s with the help of Scottish Natural Heritage and the Scottish Local Authorities. The catalogue consists of two parts: a computer database with information about each route, and 1:50,000 scale digital maps.
Catchment		The area contributing flow to a point on a drainage system.
Case for Investment	**CFI**	This is business case for the full A9 Dualling Scheme (Perth to Inverness) taking into account the strategic benefits which individual schemes cannot realise.
Chainage		Topographical reference for distance which is measured and marked between two points on the land.
Channel morphology		Physical characteristics of stream channels, such as width/depth ratio and sinuosity.
Code of Construction Practice	**CoCP**	A series of objectives and measures to be applied throughout the construction period by the Contractor to manage and operate the construction works, to maintain satisfactory levels of environmental protection and limit disturbance.
Community		Assemblage of interacting populations that occupy a given area.
Community Severance		The separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows.
Compulsory Purchase Order	**CPO**	A legal document giving the government (Scottish Ministers) power to compulsorily purchase the areas of land necessary for the construction of the scheme.
Conceptual Site Model	**CSM**	One of the primary planning tools that can be used to support the decision making process managing contaminated land and groundwater on a large scale.
Coniferous woodland		An area of woodland with predominantly coniferous tree species (less than 10% deciduous trees in the canopy).
Conservation Area	**CA**	Area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance. Designated under section 61 Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997.
Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)		Regulations which transpose the EC Habitats Directive into national law. The Regulations place a duty on the Secretary of State to propose a list of sites which are important for either habitats or species (listed in Annexes I and II of the Habitats Directive respectively) to the EC. They also provide for the control of potentially damaging operations, whereby consent from the country agency may only be granted once it has been shown through appropriate assessment that the proposed operation will not adversely affect the integrity of the site.
Construction Environmental Management Plan	**CEMP**	This will be an expanded and more detailed version of the earlier Environmental Management Plan (EMP) and should contain all the information required for the appropriate management of environmental effects during construction of the project.
Construction Method Statement	**CMS**	A document that details the way a work task or process is to be completed.
Contaminated land		The Environment Protection Act 1990 defines contaminated land as '*any land which appears to the local authority as to be in such condition, by reason of substances, on or under the land, that significant harm is being caused or there is a significant possibility of such harm being caused; … or pollution of controlled water is being, or likely to be caused*'.
Contractor		The successful tenderer in the construction process.

Controlled Activity Regulations (Scotland) 2011 as amended	**CAR**	Controls all engineering activity in or near watercourses.
Core Path		Paths, waterways or any other means of crossing land to facilitate, promote and manage the exercise of access rights under the Land Reform (Scotland) Act 2003, and are identified as such in access authority Core Path Plans.
Couch		Above-ground otter shelter.
Cropmark		Marks visible in growing and ripening crops, especially via aerial photography, which reflect the differences in the subsoil beneath.
Culvert		A metal, wooden, plastic, or concrete conduit through which surface water can flow under or across roads.
Cumulative Impacts		Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project'. Cumulative impacts can be identified as either the combined effect of different environmental impacts on a single receptor/resource, or the combined effect of impacts from a number of different proposed developments.
Decibel	**dB**	The range of audible sound pressures is approximately 0.00002 Pa to 00 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Deciduous		Trees and shrubs that shed their leaves annually.
Historic Gardens and Designed Landscapes	**HGDL**	Gardens and designed landscapes are an important element of Scotland's historic environment and landscape. They contribute to our culture, enrich the texture and pattern of our landscapes and form a unique record of social, cultural and economic change through time. They exemplify unique artistic talent, provide the setting of buildings and monuments, offer rich and varied habitats for nature conservation and can form critical repositories of rare or champion trees, shrubs and plant material.
Design Manual for Roads and Brides	**DMRB**	A series of 15 volumes that provide standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
DMRB Stage 1		As defined in TD37/93 Scheme Assessment Reporting of the DMRB Stage 1 identifies environmental, engineering and traffic advantages, disadvantages and constraints associated with broadly defined improvement strategies.
DMRB Stage 2		As defined in TD37/93 Scheme Assessment Reporting of the DMRB Stage 2 identifies factors that are to be taken into account in choosing alternative routes or improvement schemes and identifies environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with those routes or schemes.
DMRB Stage 3		As defined in TD37/93 Scheme Assessment Reporting of the DMRB Stage 3 identifies advantages, disadvantages, in environmental, engineering, economic and traffic terms, of the Overseeing Departments preferred route or scheme option.
Desk study		Assessment of a site usually preceding ground investigations typically incorporating a review of available site information, consultation with relevant bodies and a site visit.
Detention pond		A place for temporarily storing water which delays the flow of water downstream.
Diffuse pollution		Contamination and pollution arising from many dispersed and different sources.

Do-Minimum Scenario	**DM**	The base situation where there are no modifications to the existing road network. May also refer to the minimum modifications, which will necessarily take place in the absence of a proposed scheme.
Do-Something Scenario	**DS**	The situation following proposed modifications to the road network brought about as a result of the Proposed Scheme.
Drey		The most common nest type or dwelling place for squirrels comprising a round ball of twigs, leaves and bark, which is frequently built close to the tree trunk or in branch forks to provide shelter from the elements.
Drift deposits		Drift geology overlying bedrock.
Drinking Water Protected Area	**DWA**	Those bodies of water in the Scotland River Basin District which are used for the abstraction of drinking water, protected areas designated under the Water Framework Directive (2000/60/EC).
Dual Carriageway	**D2AP**	Dual, all-purpose, two-lane carriageway.
Dualling		The widening of an existing road in order to provide two carriageways in both directions.
Dung pit		A shallow hole or scrape dug by an animal into which dung and/or urine is deposited.
Earthworks		Works created through the moving of quantities of soil or unformed rock.
Ecological Clerk of Works	**ECoW**	A qualified ecologist who supervises construction sites, ensuring that ecological impacts are minimised and that the law relating to protected species etc. is complied with.
Ecological receptors		Living organisms, habitats, or natural resources that could be impacted by the construction or operation of the proposed scheme.
Ecology		The branch of biology concerned with the relations of organisms to one another and to their physical surroundings.
Ecosystem		A biological community of organisms interacting with one another and the surrounding physical environment.
Effect		The result of change or changes on environmental receptors.
Electrofishing		A fish sampling technique using electric currents and fields to control fish movement and/or immobilize fish, allowing capture.
Environmental Impact Assessment	**EIA**	The process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.
Environmental Management Plan	**EMP**	Document which describes the processes to be followed to ensure compliance with environmental legislation and policy and minimise harm to the environment.
Environmental Quality Standards	**EQS**	The maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the Water Framework Directive.
Environmental Statement	**ES**	Document provided by the Developer to the Competent Authority, containing environmental information required under Article 5 of Directive 85/337/EEC as amended.
European Protected Species	**EPS**	Species of plants and animals (other than birds) protected by law throughout the European Union. They are listed in Annexes II and IV of the European Habitats Directive.
Fauna		Referring to animals of a particular region or habitat.
Fill		Material deposited by man in ground depression or excavated area.
Floodplain		Land adjacent to a river, which is subject to regular flooding.
Flora		Referring to plants of a particular region or habitat.

Flood Risk Assessment	**FRA**	An assessment of the risk of flooding from all flooding mechanisms and the identification of mitigation measures.
Fluvial geomorphology		The study of landforms associated with river channels and the sediment processes which form them.
Gantry		A framework that spans a road or railway track.
Geological Conservation Review Sites	**GCRs**	The aim of the Geological Conservation Review Series is to provide a public record of the features of interest and importance at localities already notified or being considered for notification as 'Sites of Special Scientific Interest' (SSSIs). The sites selected – GCR sites – form the basis of statutory geological and geomorphological site conservation in Britain.
General Inspection		This is a visual inspection of all parts of a structure without the need for special access equipment and are required not more than 2 years.
Geomorphology		The branch of geology concerned with the structure, origin and development of topographical features of the earth's crust.
Glacial Till		Glacial till is that part of glacial drift which was deposited directly by the glacier.
Grade-separated junction	**GSJ**	A type of junction where the connecting carriageways of a junction are separated by a height (grade) allowing vehicles to join and leave the main road using slip roads.
Ground Investigation	**GI**	Exploratory investigation to determine the structure and characteristics of the ground influenced by a development. The collected information is used to establish or predict ground and groundwater behaviour during, and subsequent to, construction.
Ground-truthing		Verification on the ground of conditions on a site.
Groundwater		Water below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
Groundwater Dependant Terrestrial Ecosystem	**GWDTE**	Wetlands which critically depend on groundwater flows and /or chemistries.
HA Loading	**HA**	HA Loading is a formula loading representing normal traffic in Great Britain and includes impact loading.
Habitat		Term most accurately meaning the place in which a species lives, but also used to describe plant communities or agglomerations of plant communities, as used, for example in a Phase 1 Habitat Survey.
Habitat Action Plan	**HAP**	Objectives set by the British government to conserve the biodiversity in given habitats.
Habitats Directive		EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
Habitat fragmentation		Describes the breaking up of an organism's preferred environment/habitat. Occurs naturally through geological processes that alter the layout of the physical environment over long periods of time, or through human activities, such as land conversion.
HB Loading	**HB**	HB Loading is an abnormal loading and includes impact loading.
Heavy Duty Vehicle	**HDV**	Any vehicle with a gross weight greater than 3.5t, including heavy goods vehicles (HGVs) and coaches.
Heavy Goods Vehicle	**HGV**	Vehicles with 3 axles (articulated) or 4 or more axles (rigid and articulated).
Historic Environment Record	**HER**	A record of known archaeological and cultural heritage sites and assets.
Holt		Deep underground otter shelter.

Hydrogeology		The branch of geology that deals with the occurrence, distribution, and effect of ground water.
Hydrological		The exchange of water between the atmosphere, the land and the oceans.
Impact		Any changes attributable to the proposed scheme that have the potential to have environmental effects (i.e. the causes of the effects).
Improved grassland		Grasslands that have been so modified by fertilisers, drainage or grazing that they have lost most of the species expected in unimproved grassland.
Indicator species		A species that is characteristic of a particular habitat. The disappearance of such a species is an early warning of habitat degradation.
Infrastructure	**IMFDP**	The basic structure or features of a system or organisation.
Inner Moray Firth Development Plan		Is a local plan published in July 2015 that focuses on where development should and should not occur in the Inner Moray Firth area over the next 10-20 years.
Interim Advice Note	**IAN**	Specific guidance documents produced by Highways England which shall only be used in conjunction with works on motorways and trunk roads in England, subject to any specific implementation instructions contained within an IAN.
LA		A-weighted sound pressure level (in decibels, dB). The measured sound level incorporating a logarithmic base and weighting system to approximate the manner in which humans perceive sound. An increase of 10dB is approximately equivalent to a perceived doubling of loudness.
LA10,T **LA10,18hr**		A-weighted sound pressure level (in decibels, dB) that is exceeded for 10% of the given time period. 'T'. For road traffic, it is typically expressed as the arithmetic average of hourly LA10 values over an 18 hour day (06:00 – 24:00).
Laeq, T		Equivalent continuous A-weighted sound pressure level (in decibels, dB), over a given time interval. Where a time interval is not given it is typically considered as a continuous level.
Landform		Combination of slope and elevation producing the shape and form of the land surface.
Landscape		Human perception of the land, conditioned by knowledge and identity with a place.
Land Capability for Agriculture	**LCA**	The Land Capability Classification for Agriculture uses the physical characteristics of the land (including its soil, climate, topography and relief) to determine what crops it should be able to grow and how well it should be able to grow them. There are seven classes, class 1 being land capable of producing a wide variety of crops and class 7 being land of very limited agricultural value.
Land-take		Acquired land which is necessary to construct the scheme and associated infrastructure and to undertake the essential environmental mitigation measures.
Latrine		A series of pits dug by a badger where faeces (and urine) is deposited or a collection of water vole droppings habitually deposited in a single location typically used to define territorial boundaries.
Left in/left out		Junctions which remove cross-carriageway turning movements and are theoretically safer than junctions which allow all movements as they remove conflicting traffic streams. This is particularly useful on fast-moving roads, where high traffic speeds make judging suitable gaps in approaching traffic more problematic.

Lead Traffic & Economic Advisor	**LTEA**	Transport Scotland's appointed advisor for traffic and economics. Currently AECOM for the A9 Dualling Programme.
Listed Building		Building included on the list of buildings of special architectural or historic interest and afforded statutory protection under the 'Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997' and other planning legislation. Classified categories A, B and C.
Local Biodiversity Action Plan	**LBAP**	A Local Biodiversity Action Plan (LBAP) is a document that gathers together information about the ecosystems and their associated habitats and species in a particular area and sets out actions for their protection and enhancement.
Local Landscape Character Area	**LLCA**	An area outlined as having distinct characteristics based on landscape features.
Local Transport Strategy	**LTS**	A framework for how a local planning authority intends to deliver on its own and national objectives at a local level.
Lying-up site		An area where an otter will rest, usually a holt or couch.
Made ground		Ground comprised of material deposited by man i.e. not natural.
Magnitude		Size, extent, scale or duration of an impact.
Mammal ledge		A shelf built within a culvert to facilitate mammal passage, accessible at both ends from the bank and the water.
Marshland		Low-lying wet land with grassy vegetation; usually a transition zone between land and water.
Maximum Sound Level, dB LAmax,T		The highest value of the A-weighted sound pressure level that occurs during a given event or time period. The time-weighting should be specified.
Mitigation		Term used to indicate avoidance, remediation or alleviation of adverse impacts.
Mixed plantation woodland		Planted stands with either broadleaf or conifer species comprising 10-90% of the canopy.
Natal den		The small space (usually a holt or couch) used by a female otter to give birth and raise cubs for a period of up to three months.
National Cycle Network	**NCN**	The National Cycle Network is a series of traffic-free paths and quiet, on-road cycling and walking routes that connect to every major town and city.
National Monuments Record of Scotland	**NMRS**	The archive of the sites, monuments and buildings of Scotland's past maintained by Royal Commission on the Ancient and Historical Monuments of Scotland.
National Planning Framework 3	**NPF3**	The spatial expression of the Scottish Government's Economic Strategy, it sets out a long-term vision for development and investment across Scotland over the next 20 to 30 years.
National Transport Strategy	**NTS**	Published in 2006 the NTS sets the long term vision for the Scottish Government's transport policies.
National Vegetation Classification	**NVC**	A system to describe British vegetation types, whereby each vegetation type has a different 'code'.
Native		A species occurring naturally, in its normal geographic range.

Natura 2000 Site		Natura sites represent the very best of Scotland's nature. Natura is the term given to Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). These internationally important sites are designated under two pieces of European legislation relating to nature conservation, the Habitats (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) and Birds Directives (Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds).
Neutral grassland		Grassland communities that grow on neutral soils (pH 5.5 — 7).
Non-motorised users	**NMU**	Pedestrians, cyclists and equestrians.
Non-prime land		Agricultural land of Land Capability for Agriculture (LCA) classes 3.2 to 7.
Notable species		Species which are below Red Data Book species in terms of threat status.
NOx		A general term for the oxides of nitrogen including nitric oxide (NO), nitrogen dioxide (NO2), and nitrous oxide (N2O).
Offsetting		The process of compensating for something with something else.
Open space		Any land laid out as public parks or used for the purpose of public recreation, or land which is a disused burial ground.
Ordnance Datum	**OD**	Mean sea level calculated used as the official basis for height calculation on British maps.
Ornithological		The branch of zoology that deals with the study of birds.
Outfall		The place of discharge e.g. where a sewage pipe discharges into a river.
Peatland		Wetlands with a thick water-logged organic soil layer (peat) made up of dead and decaying plant material.
Phase 1 Habitat Survey		This identifies the different habitats that are contained within or make up a site, and the key plant species for each of those habitat types.
Pile		A heavy stake or post made out of timber, steel, reinforced concrete or pre-tensioned concrete, driven into the ground to support foundations.
Piling		The act of installing piles.
Plantation woodland		Woodland of any age that obviously originated from planting.
PM10		Particulate matter – particles in this size range have an effective aerodynamic diameter of less than 10 micrometres (µm).
Point pollution		A point source of pollution is a single identifiable localised source of air, water, thermal, noise or light pollution.
Policy Advice Note	**PAN**	Supporting document to National Planning Policy Guidelines, which disseminates good practice and provides more specific design advice of a practical nature.
Pollution Prevention Guidelines	**PPG**	PPGs are based on relevant legislation and good practice. Following the guidelines will help contractors to manage environmental responsibilities, prevent pollution and comply with the law.
Pool and riffle sequence		In a flowing stream a riffle-pool sequence develops as an area of alternating areas of relatively shallow and deeper water. Riffles describe shallow water where the flow is rippling over gravel deposits whereas pools are deeper and calmer areas.
Potential couch/holt/hover		Tunnels, cavities or other structures which may be used by otters but which cannot be confirmed as being used in the absence of signs.
Preliminary Engineering Services	**PES**	The A9 PES includes the preparation of an A9 Dualling Preliminary Engineering Assessment which identifies the baseline (existing) conditions and constraints as well as assessing the advantages and disadvantages associated with each indicative A9 route corridor. This assessment is the equivalent to the DMRB Stage 1 assessment.

Principal Inspection	**PI**	This is an inspection which requires a close examination within touching distances of all parts of the structure and are required in intervals not exceeding 6 years.
Prime agricultural land		Agricultural land of Land Capability for Agriculture (LCA) classes 1, 2 and 3.
Priority habitat		Those habitats which have been identified as being most threatened and requiring actions under the UK Biodiversity Action Plan.
Priority species		Those species which have been identified as being most threatened and requiring actions under the UK Biodiversity Action Plan.
Proposed Scheme		The scheme design for the Dalraddy to Slochd section of the A9 used as the basis for environmental assessment and reporting.
Public Right of Way	**PRoW**	A public right of way is a defined route which has been used by the general public for at least 20 years and which links two public places.
Q95		The river flow that is exceeded for 95% of the year.
Ramsar sites		Internationally important wetland identified for conservation under the Ramsar convention (1971).
Receptor(visual)		A dwelling, workplace or other building, outdoor space, viewpoint, road or footpath with views which may be changed in character and visual amenity by a proposed development.
Red Data Book		Contains list of species whose continued existence is threatened.
Red list species		Bird species in severe population decline.
Refuge/refugia		Any structure that provides animals temporarily with a place they can retreat to and feel secure. This can be rock or log piles, dense scrub or mammal burrows
Regional Transport Strategy	**RTS**	Strategies developed by the Scottish Regional Transport Partnerships which enhance economic well-being; promote safety, social inclusion and equal opportunity; plan for a sustainable transport system; and integrate across boundaries with other Partnerships. These Strategies take account of future needs and set priorities for transport development and improvement.
Regionally Important Geological and Geomorphological Sites	**RIGS**	Sites designated by regional geological groups on locally developed criteria.
Residual impacts		Residual impact means the environmental impact after the provision of mitigation measures, if any.
Riparian habitat		Natural home for plants and animals occurring in a thin strip of land bordering a stream or river.
River Basin District		The area of land and sea, made up of one or more river basins, together with the associated groundwater and coastal waters, identified by the Water Framework Directive as the main unit for the management of river basins.
River basin management plan	**RBMP**	A plan setting out actions required within a river basin to achieve set environmental quality objectives, reviewed on a six yearly basis.
River Habitat Survey	**RHS**	A survey to assess the physical structure of freshwater streams and rivers, providing a broad assessment of habitat quality.
Roost		Any resting site used by bats including maternity roosts which are used by females and their young, hibernacula which are used during winter hibernation and transitional roosts which may be used at any time.
Route corridor		A defined area around the route alignment.
Runoff		Water that flows over the ground surface to the drainage system. This occurs if the ground is impermeable or if permeable ground is saturated.
Salmonid		Water containing fish of the family Salmonidae, e.g. salmon, trout.

Schedule I Protected Species		Species protected under Schedule 1 of the Wildlife and Countryside Act 1981.
Scheduled Monument	**SM**	A monument which has been scheduled by the Scottish Ministers as being of national importance under the terms of the 'Ancient Monuments and Archaeological Areas Act 1979'.
Scottish Environment Protection Agency	**SEPA**	This is Scotland's principal environmental regulator, protecting and improving Scotland's environment.
Scottish Natural Heritage	**SNH**	This is an organisation that promotes care for the natural heritage, wildlife, habitats, rocks and landscapes of Scotland.
Scottish Planning Policy	**SPP**	A statement of Scottish Government policy on how nationally important land use planning matters should be addressed across the country.
Scrub		Climax vegetation dominated by locally native shrubs, usually less than 5m tall.
Secondary impacts		Impacts that are caused by the proposed action and are later in time or farther removed in distance but are still reasonably foreseeable. Secondary impacts may include induced changes to land-use patterns, population density, or growth rate and related effects on natural systems.
Semi-improved grassland		Grassland that has been modified by fertilizers, drainage or intensive grazing. Contain less species diversity than unimproved grasslands.
Semi-natural Ancient Woodland		Areas that appear as wooded on 1860 maps but not maps from 1750 i.e. woodland that appeared between these two dates.
Sett		The burrow system of badgers comprising a series of underground tunnels and chambers. There are several categories of sett including a main sett, annexe sett, subsidiary sett and outlier sett.
Severance		The separation of communities from facilities and services they use within their community. Alternatively, in relation to agricultural land, the division of plots of land into separate land parcels, potentially affecting access or creating areas that may be impractical for agricultural use. It can also apply to the separation of houses from gardens.
Site compound		A secure area close to the construction site which provides full site services including storage for equipment, materials and fuel, offices and amenity areas.
Site of Importance to Nature Conservation	**SINC**	Non-statutory designation which seeks to protect areas of high wildlife value at a local level.
Sites and Monuments Record	**SMR**	A list of known archaeological sites held by a local planning authority.
Sites of Special Scientific Interest	**SSSI**	Areas of national importance. The aim of the SSSI network is to maintain an adequate representation of all natural and semi-natural habitats and native species across Britain. The site network is protected under the provisions of Sections 28 and 19 of the Wildlife and Countryside Act 1981 as well as the Amendment Act 1985 and the Environmental Protection Act 1990.
Soakaway		A deep hole used for drainage, where rainwater and other waste water drains directly into the ground, without connection to any mains drainage or sewerage pipes.
Special Area of Conservation	**SAC**	An area designated under the EC Habitats Directive to ensure that rare, endangered or vulnerable habitats or species of community interest are either maintained at or restored to a favourable conservation status.

Special Landscape Areas	**SLA**	Special Landscape Areas will be designated for their scenic quality, enjoyment, rarity and views. SLAs will replace existing Areas of Great Landscape Value (AGLVs) when new Local Development Plans are adopted.
Special Protection Area	**SPA**	An area designated under the Wild Birds Directive (Directive74/409/EEC) to protect important bird habitats. Implemented under the Wildlife and Countryside Act 1981. Under the Habitats Directive, all SPAs will be proposed Special Areas of Conservation.
Species Action Plan		UK Biodiversity Action Plans detailing information on the conservation status of 382 species and the actions necessary to achieve the action plan targets.
Spraint		Otter faeces.
Stakeholder		A person or group that has an investment, share or interest in something.
Strategic Environmental Assessment	**SEA**	The process by which information about the environmental effects of proposed plans, policies and programmes are evaluated.
Strategic Transport Project Review	**STPR**	A periodic review of the Scottish transport which is about delivering a strategic transport network which will benefit the whole of Scotland and deliver on the priorities set out in the Government Economic Strategy, the National Transport Strategy, the National Planning Framework and the Scottish Climate Change Bill. It identifies improvements on the national rail and road networks in Scotland to meet the up and coming challenges.
Superficial Deposits		The youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back 1.8 million years from the present.
Sustainable drainage systems	**SUDS**	A sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques. Referred to in earlier guidance as 'Sustainable *Urban* Drainage Systems'.
Transport Model for Scotland	**TMfS**	Transport Model for Scotland – Transport Scotland's national transport model.
Topsoil		The upper, outermost layer of soil.
Tree Preservation Order	**TPO**	This is a legal Order that protects trees from being cut down, uproot, wilfully destroy a tree or wilfully damage. Top or lop a tree in such a manner as to be likely to destroy it without the consent of the planning authority.
Type A lay-by		This is a parking area for vehicles that incorporates a segregation island between the lay-by and the carriageway.
Type B lay-by		This is a parking area for vehicles that does not have a segregation island between the lay-by and the carriageway.
Undesignated cultural heritage assets		An asset is taken as being any cultural heritage site, feature, area or landscape.
Vibro-piling		A method of driving a pile into the ground using rapid repeated oscillations of the pile.
Visual envelope		The visual envelope illustrates the extent of potential visibility to or from a specific area.
Vulnerable groups		Children, elderly and disabled.
Waterfowl Habitat		Vegetation and water regimes which facilitate the breeding, nesting, feeding and cover required for the production and proliferation of ducks, geese and other waterfowl.

Water Environment and Water Services (Scotland) Act 2003	**WEWS**	This Act granted power to Scottish Ministers to introduce regulatory controls (refer to Controlled Activities Regulations (CAR) above) to protect and improve Scotland's water environment, including wetlands, rivers, lochs, transitional waters (estuaries), coastal waters and groundwater.
Water Framework Directive	**WFD**	Wide-ranging European environmental legislation (2000/60/EC). Addresses inland surface waters, estuarine and coastal waters and groundwater. The fundamental objective of the WFD is to maintain 'high status' of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least 'good status' in relation to all waters by 2015.
Water quality		The chemical and biological status of various parameters within the water column and their interactions, for example dissolved oxygen, indicator metals such as dissolved copper, or suspended solids (the movement of which is determined by hydrological process and forms geomorphological landforms).
Wildfowl		Any wild bird such as ducks, geese or swans.
Wildlife and Countryside Act 1981	**WCA**	Principal mechanism for wildlife protection in the UK.
Wide Single Carriageway with three lanes	**WS2+1**	Wide single carriageway with three lanes, the middle of which switches direction every so often to provide an overtaking lane to each side in turn. Based on the principle that alternate WS2+1 layouts are provided to ensure balanced overtaking opportunities in each direction.
Zone of influence		An area along a proposed development over which potential ecological effects extend.
Zone of Theoretical Visibility	**ZTV**	Area in which a proposed development would theoretically be visible, based on a 'bare-ground' model which takes account of topography but not the screening effects of structures (e.g. buildings), vegetation (e.g. woodlands). May also be referred to as *Zone of Visual Influence.*

Part 1: The Scheme

1. Scheme Background

1.1. Background

1.1.1. The A9 corridor forms a strategic link between Central Scotland and the Scottish Highlands and is vital for Scotland's sustainable economic growth. The Strategic Transport Projects Review (STPR) [Ref 1-1] in 2009 identified dualling of the A9 as a priority Trunk Road intervention. In December 2011, the Scottish Government's Infrastructure Investment Plan (IIP) [Ref 1-2] committed to dual the A9 trunk road between Perth and Inverness by 2025 (see Volume 2,Figure 1.1). The delivery of this Project forms part of this commitment.
The A9 Perth to Inverness is 177 km long of which 129 km requires dualling.

Key characteristics of the A9 (Perth to Inverness) include:

- a higher than average rate of serious or fatal accidents;
- a lower than average general accident rate;
- approximately 20% of accidents are winter weather related;
- traffic flows that vary between circa 23,000 (2012) Annual Average Daily Traffic (AADT) at Perth and Inverness to circa 8000 (2012) AADT south of Aviemore;
- marked seasonal fluctuations in traffic flows;
- a changing cross section from single carriageway through localised WS2+1 (overtaking) sections to dual carriageway;
- numerous at-grade junctions;
- driver frustration due to lack of guaranteed overtaking opportunities; and
- a surrounding environment of high sensitivity.

1.1.2. The Route has been spilt into 3 Sections for the purposes of contracting design work.

The 3 Sections have been broken down as follows:

Southern Section – Design Consultant: CH2M Hill / Fairhurst Joint Venture

- Glen Garry to Dalwhinnie – DMRB Stage 2
- Dalwhinnie to Crubenmore – DMRB Stage 2
- Crubenmore to Kincraig – DMRB Stage 2

Central Section – Design Consultant: Jacobs

- Luncarty to Pass of Birnam – DMRB Stage 3 / Draft Orders
- Pass of Birnam to Tay Crossing – DMRB Stage 2
- Tay Crossing to Ballinluig – DMRB Stage 2
- Pitlochry to Killiecrankie – DMRB Stage 2
- Killiecrankie to Glen Garry – DMRB Stage 3

Northern Section – Design Consultant: AtkinsMouchel Joint Venture

- Dalraddy to Slochd – DMRB Stage 2
- Tomatin to Moy – DMRB Stage 2

The Northern Section extends between Dalraddy and Inverness (see Volume 2, Figure 1.2) and comprises 34 km of existing single carriageway to be dualled and 16.5 km of existing dual carriageway.

1.1.3. In addition to the above referenced sections, it is noted that the Kincraig to Dalraddy project is currently under construction (expected to be complete summer 2017).

1.1.4. The Northern Section is subdivided into two projects for the purposes of design and statutory approvals:

- Dalraddy to Slochd; and
- Tomatin to Moy.

1.1.5. The Dalraddy to Slochd scheme is approximately 25km in length and extends from the boundary with the Kincraig to Dalraddy Scheme (currently under construction) at Dalraddy, approximately 5.0km southwest of Aviemore to the tie-in with the existing dual carriageway at the north in the vicinity of Slochd Summit, approximately 13.5km northwest of Aviemore. Traffic flows on this section (recorded near Slochd Summit) were approximately 7,600 AADT in 2012.

1.1.6. Terrain consists of the Monadhliath Mountains to the west and Strathspey to the east. The Highland Mainline railway lies adjacent to the A9 between Kinveachy and Black Mount, crossing from east to west of the road at the Slochd Beag structure. There are two major watercourse crossings, River Dulnain and Baddengorm, and numerous minor watercourses. Over the length of the scheme, the elevation rises as the A9 progresses north with the highest point recorded at Slochd summit.

1.1.7. The Preliminary Engineering Services (PES) [Ref 1-3] Junction and Access Strategy, identified three potential grade separated junction locations in this section. The options for these junctions and the closure of accesses/minor junctions are considered in the Design Manual for Roads and Bridges (DMRB) Stage 2 assessment presented in this report.

1.1.8. Existing Non-Motorised Users (NMU) networks, including designated core paths and National Cycle Network (NCN) 7, run on both sides of the A9 in the vicinity of Aviemore. Further north, NCN7 follows the former A9 alignment, and the A9 crosses NCN7 by means of Slochd Beag underbridge.

1.1.9. AtkinsMouchel Joint Venture were appointed by Transport Scotland in December 2014 to develop the scheme proposals through DMRB Stage 2, DMRB Stage 3, statutory processes, procurement and site supervision for the Northern Section of the A9 Trunk road between Dalraddy and Inverness. This report is the Stage 2 assessment for the Dalraddy to Slochd (Project 11).

1.2. Previous Studies

A9 Route Action Plan and Route Strategy, 1995 – 1997

1.2.1. Scott Wilson developed a Route Action Plan culminating in a Route Strategy [Ref 1-4] for the A9 corridor which considered schemes to improve safety and relieve driver stress. A wide range of carriageway improvement options were considered including climbing lanes, wide single carriageways and dual carriageways in order to address operational problems on the A9. Within the vicinity of the Proposed Scheme the following schemes were identified within the Route Action Strategy:

- Scheme 12 – Kincraig to Dalraddy Carriageway widening (wide single 2-lane carriageway) over a length of 4km;
- Kincraig to Dalraddy carriageway widening (2+1 lane) over a length of 4km;
- Scheme 13 – Kincraig to Dalraddy Dual Carriageway (upgrade to dual 2-lane carriageway) over a length of 4km;
- Scheme 14 - Kinveachy Northbound Climbing Lane commencing 3.1km north of Granish and covering a length of 0.7km;
- Scheme 15 – Carrbridge (South & North) Northbound Climbing Lane – 0.3km north of river bridge near Carrbridge to 1.9km north of the A938 covering a length of 4.2km;
- Junction Improvement – B9152 Aviemore (Lynwilg), southbound deceleration; and
- Junction Improvement – A95 Aviemore (Granish), low cost grade separation.

1.2.2. Schemes 14 and 15 identified in the Route Action Strategy fall in the section of the A9 between Dalraddy and Slochd. Additionally, the two junction improvements identified are also within the bounds of the Dalraddy to Slochd scheme. The above schemes formed part of 11 route strategies which included variations of upgrades across the A9 between Perth and Inverness. Of the strategies identified:

- Strategy 6 – comprised dualling of the A9 between Perth and Inverness along the entirety of the route;
- Strategy 9 – comprised the ‘best value for money’ strategy which identified making targeted improvements on the A9 (including the 2+1 scheme at Kincraig to Dalraddy) with low cost schemes; and
- Strategy 11 – ‘the preferred strategy’ – a combined approach taking in to account the best value for money and longer term strategies in order to deliver improved conditions on the A9. This strategy included the 2+1 scheme at Kincraig to Dalraddy and the Carrbridge (south & north) northbound climbing lane.

Following the publication of the study one dualling scheme was brought forward at that stage at Crubenmore.

Strategic Transport Projects Review (STPR)

1.2.3. The STPR was published by Transport Scotland in December 2008 and it defined the most appropriate strategic investments in Scotland's national transport network to 2022. The STPR and the associated Strategic Environmental Assessment (SEA) assessed the wider strategic transport corridor between Perth and Inverness and identified the following objectives with respect to the A9 corridor:

- To promote journey time reductions, particularly by public transport, between the central belt and Inverness primarily to allow business to achieve an effective working day when travelling between these centres;
- To improve the operational effectiveness of the A9 as it approaches Perth and Inverness;
- To reduce journey time and increase opportunities to travel between Inverness and Perth (and hence onwards to the central belt); and
- To address issues of driver frustration relating to inconsistent road standard, with attention to reducing accident severity.

1.2.4. The outcome of the STPR process was a commitment by the Scottish Government to dual the A9 between Dunblane and Inverness. This final intervention identified in the STPR considers the full dualling and wider improvement of the A9 between Dunblane and Inverness.

1.2.5. The STPR stated that the first phase of the A9 dualling would consist of:

- Grade separation of all junctions on the A9 from (and including) Keir Roundabout to south of Broxden Roundabout;
- A9 Dual Carriageway from Perth to Blair Atholl;
- Grade separation of Broxden Roundabout and Inveralmond Roundabout at Perth; and
- Implementation of climbing lanes, 2+1 sections and junction improvements between Blair Atholl and Inverness.

1.2.6. The subsequent phases of the A9 dualling would then consist of:

- dualling the A9 between Aviemore and Inverness; and
- dualling the A9 between Blair Atholl and Aviemore.

1.2.7. The STPR stated that the A9 dualling would be 'expected to provide a significant contribution to the Scottish Government's purpose of increasing sustainable economic growth. In addition, this will also contribute to the national objectives of promoting journey time reductions between the Central Belt and Inverness and the reduction in accident rates. The intervention also addresses the corridor specific objectives of improving the operational effectiveness of the A9 on approach to Perth and addressing issues of driver frustration'.

1.3. A9 Programme Level Assessments

Infrastructure Investment Plan

1.3.1. Following the IIP announcement and the commitment to dual the A9, two corridor wide commissions were implemented in 2012 to help develop a consistent approach to dualling design and assessment. The IIP states that an efficient transport system is 'a key enabler for enhancing productivity and hence expanding the economic potential of the country'. The IIP commits that 'by 2025, we will have dualled the A9 between Perth and Inverness, with a view to completing the dualled road network between all our cities by 2030'. These are outlined below. The findings of these studies (and the associated reports) have informed the design approach being undertaken for the Proposed Scheme.

Preliminary Engineering Services (PES)

1.3.2. In September 2012, Transport Scotland commissioned the A9 Dualling: Preliminary Engineering Support Services Report (Jacobs, March 2014) (PES) [Ref 1-3]. The PES undertook an engineering assessment of the A9 Perth to Inverness route and produced engineering constraints mapping, route options work and other design strategies such as junction and access strategy, lay-by and rest area strategy and NMU strategies. Other activities undertaken by the PES Commission included geotechnical desk studies, topographical survey work, land referencing and stakeholder engagement. The principal output of the PES Commission was the Design Manual for Roads and Bridges (DMRB) Stage 1 assessment.

1.3.3. Concurrent with the PES, Transport Scotland also commissioned the A9 Dualling Strategic Environmental Assessment (SEA) (Halcrow/CH2MHill, June 2013). The SEA identified the key environmental and landscape issues along the length of the A9 route and assessed the potential impacts associated with the proposed works.

1.3.4. AECOM were awarded a commission in 2012 to produce an A9 corridor investment case and associated traffic and economic assessment work.

1.3.5. The PES and the SEA together were considered equivalent to a DMRB Stage 1 assessment and recommended dualling within the online corridor, broadly 200m width.

1.4. National Policy Background

1.4.1. The relevant policies and plans that are likely to affect, or be affected by the Proposed Scheme are set out in Part 3, Chapter 19, and the likely compliance of Proposed Scheme Options with the identified policies and plans is commented upon.

1.4.2. Aspects of national policy documents relevant to the A9 Dualling and the Proposed Scheme are outlined below.

National Transport Strategy (2006)

1.4.3. The National Transport Strategy (NTS) [Ref 1-5] was produced under a commitment presented in the 2004 Transport White Paper, 'Scotland's Transport Future'. The NTS is one of eight main delivery programmes for 'Choosing Our Future', Scotland's sustainable development strategy. The NTS has five high level objectives:

- Promote economic growth;
- Improve integration;

- Promote social inclusion;
- Improve safety of journeys; and
- Protect our environment and improve health.

1.4.4. One of the aims of the NTS is to deliver a world class transport system and the following key strategic outcomes were identified:

- Improve journey times and connections: to tackle congestion and the lack of integration and connections in transport which impact on high level objectives for economic growth, social inclusion, integration and safety;
- Reduce emissions: to tackle the issues of climate change, air quality and health improvement which impact on high level objectives for protecting the environment and improving health; and
- Improve quality, accessibility and affordability; to give people a choice of public transport, where availability means better quality transport services and value for money or an alternative to the car.

1.4.5. The strategic outcomes of the NTS have been used to inform the objectives for the Proposed Scheme as set out in Chapter 1, and which can be summarised as:

- To improve the operational performance of the A9;
- To improve safety for motorised and non-motorised users;
- To facilitate active travel within the corridor; and
- To improve integration with Public Transport Facilities.

Scotland's Economic Strategy (2015)

1.4.6. Scotland's Economic Strategy [Ref 1-6] sets out the Scottish Government's overarching framework for increasing competitiveness and tackling inequality in Scotland. The Strategy sets out four priorities for achieving sustainable economic growth, one of which is investing in people and infrastructure in a sustainable way.

1.4.7. The Strategy promotes investment in the nation's infrastructure in order to help businesses to grow, create employment opportunities and boost connectivity. The Strategy advocates taking a strategic and long-term approach to infrastructure investment and lists a number of major projects that are supported by the Scottish Government. This includes investment in the dualling of the A9.

Scotland's Cities: Delivering for Scotland (2011)

1.4.8. Scotland's Cities: Delivering for Scotland [1-7] was published to complement the Government's Economic Strategy. It highlighted that successful cities are 'connected cities, with strong digital and transport infrastructure'.

1.4.9. The objectives for the Proposed Scheme have been developed to further promote connectivity between Perth and Inverness thereby improving journey times and connectivity between two of Scotland's key cities in line with objectives contained within Scotland's Cities: Delivering for Scotland.

Infrastructure Investment Plan (IIP) (2011)

1.4.10. The IIP sets out the Government's plans for infrastructure investment and details why infrastructure is a key driver of both short and long-term economic growth within Scotland. The IIP vision is to create a 'secure, prosperous, confident, healthy, fair, well-connected, low carbon Scotland'.

1.4.11. The IIP states that an efficient transport system is 'a key enabler for enhancing productivity and hence expanding the economic potential of the country'.

1.4.12. The IIP commits that 'by 2025, we will have dualled the A9 between Perth and Inverness, with a view to completing the dualled road network between all our cities by 2030'.

National Planning Framework 3 (NPF3) (2014)

1.4.13. NPF3 [Ref1-8] sets the context for development planning in Scotland and provides a framework for the spatial development of Scotland as a whole. It sets out the Government's development priorities over the next 20-30 years and identifies national developments which support the development strategy. NPF3 includes 14 national developments, identified to deliver the strategy.

Within NPF3, under the spatial priorities for change it states that:
'We will complete dualling of the trunk roads between cities, with dualling of the A9 from Perth to Inverness complete by 2025 and dualling of the A96 from Inverness to Aberdeen by 2030'.

1.4.14. Furthermore it states that 'the dualling of the A9 between Perth and Inverness and improvements to the Highland Mainline railway will provide a step change in accessibility across the rural north, increase business confidence and support investment throughout the region'.

National, Regional and Local Planning Policy

1.4.15. The potential impacts and constraints associated with the Proposed Scheme Options in terms of the wider national, regional and local planning policy context are set out in Part 3, Chapter 19. This includes a review of national, regional and local planning policy and guidance documents, and consideration of the project in terms of potential policy conflicts or compliance.

1.5. A9 Dualling Programme Objectives

1.5.1. The programme objectives stated in the PES for the A9 Dualling Perth and Inverness are as follows:

(i) To improve the operational performance of the A9 by:
- Reducing journey times; and
- Improving journey time reliability.

(ii) To improve safety for motorised and non-motorised users by:
- Reducing accident severity; and
- Reducing drivers stress.

(iii) To facilitate active travel within the corridor; and

(iv) To improve integration with Public Transport Facilities.

1.6. DMRB Stage 2 Scheme Assessment Report

1.6.1. This DMRB Stage 2 Scheme Assessment Report has been prepared in accordance with the guidance contained in TD37/93 Scheme Assessment Reporting. It develops the Stage 1 work into route options for the Dalraddy to Slochd project and assesses their relative merits.

1.6.2. The purpose of this report is to identify the factors that have been taken into account in the assessment of the route and junction options, considering the objectives and the engineering, environmental, economic advantages/disadvantages and constraints associated with each.

1.6.3. Preliminary route and junction option drawings showing the options considered in this assessment are included in Volume 2 (Figures 4.1a to 4.12d inclusive) of this report.

1.7. Report Layout

1.7.1. The remaining chapters of this report adopt the structure set out in TD 37/93 of the DMRB, as follows:

- Part 1: The Scheme
  - Chapter 1: Scheme Overview
  - Chapter 2 : Existing Conditions;
  - Chapter 3 : Description of Scheme Options;
- Part 2: Engineering Assessment
  - Chapter 4 : Engineering Overview;
  - Chapter 5 : Engineering Assessment
- Part 3: Environmental Assessment
  - Chapters 6 - 19 : Environmental Assessment;
- Part 4: Traffic and Economic Assessment
  - Chapter 20 : Traffic Assessment;
  - Chapter 21 : Economic Assessment;
- Part 5: Assessment Summary and Recommendations
  - Chapter 22 : Assessment Summary;
  - Chapter 23 : Recommendation; and
- Part 6: Appendices.

1.8. Stakeholder Consultation

1.8.1. The work Transport Scotland is progressing along the A9 corridor involves a rolling programme of continuous engagement with local communities and stakeholders. There have been a number of public exhibitions that have taken place as part of the Stage 1 process with further meetings and consultation events held as part of the Stage 2 assessment. These are aimed at ensuring local businesses, communities and individuals are kept informed of developments and can have their feedback taken into account as the design develops. For the Dalraddy to Slochd project the following Stage 2 exhibitions have taken place in Aviemore and Carrbridge:

- Mainline and Junction location exhibition, 2nd and 3rd February 2016
- Mainline and Junction layout exhibition, 16th and 17th June 2016

1.8.2. There are numerous local stakeholders who have already been consulted as part of the Dalraddy to Slochd scheme development, and will be subject to regular engagement as the project progresses. These include (but are not limited to):

- Landowners and agents – within the 200m corridor (refer to 1.2.14);
- Aviemore and Vicinity Community Council;
- Carrbridge Community Council;
- Nethy Bridge Community Council;
- Boat of Garten Community Council;
- Grantown on Spey Community Council;
- The Highland Council;
- Public Utilities and Statutory Undertakers including Scottish and Southern Energy, Scottish Water, BTopenreach;
- Scottish Natural Heritage (SNH);
- Scottish Environmental Protection Agency (SEPA);
- Historic Environment Scotland;
- Cairngorms National Park Authority (CNPA);
- Various Non-Motorised User (NMU) Groups;
- Forestry Commission Scotland; and
- Network Rail.

1.9. References

1-1 Strategic Transport Projects Review (2009). Scottish Government.
1-2 Infrastructure Investment Plan (2011). Scottish Government.
1-3 A9 Dualling Preliminary Engineering Support Services – DMRB Stage 1 Assessment (2014) Jacobs.
1-4 A9(T) Perth to Inverness Development of a Route Strategy – Phase 3 Final Report (1997). Scott Wilson Kirkpatrick.
1-5 National Transport Strategy (2006). Scottish Executive.
1-6 Government Economic Strategy (2007). Scottish Government.
1-7 Scotland's Cities: Delivering for Scotland (2011). Scottish Government.
1-8 National Planning Framework 3 (2014). Scottish Government.

2. Existing Conditions

2.1. Introduction

2.1.1. This chapter of the report describes the engineering conditions of the existing A9 single carriageway Trunk Road from Dalraddy to Slochd. The existing route is described with regards to engineering factors including traffic flows, pavement construction, junctions, structures, roadside features, drainage and public utilities. The existing local roads are also described within this chapter. Refer to Part 3 of this report for full details of environmental constraints and assessment.

2.1.2. For ease of reporting, given the total length of the scheme and the variability in conditions along the route, the Dalraddy to Slochd scheme has been subdivided into 13 sections as presented in Table 2.1.1. A detailed breakdown of each section is included within chapter 3 of this report. Scheme chainages are contained in the options layouts (Volume 2, Figures 4.1, 4.2 and 4.3).

Table 2.1.1: Dalraddy to Slochd Route Sections

Section	Start chainage (m)	End chainage (m)
1	0	2,500
2	2,500	3,500
3a	3,500	5,500
3b	5,500	6,700
4	6,700	7,900
5	7,900	10,400
6a	10,400	11,700
6b	11,700	13,000
7	13,000	16,300
8	16,300	17,600
9	17,600	20,900
10	20,900	23,100
11	23,100	25,030

2.2. Scheme Location and Environment

Location

2.2.1. The scheme is located around Aviemore, Strathspey and Strath Dulnain from Dalraddy in the south to Slochd in the north and is approximately 25.03km long (see Volume 2, Figure 1.3).

Topography

2.2.2. The southern part of this section of the A9 is within a wide river valley which is prone to flooding surrounded by steep forested hills. The northern extents lie within steep terrain and narrow rockside cuttings on approach to Slochd Summit. The height range of the existing A9 ranges from 220mAOD to 405mAOD.

Table 2.2.1: Surrounding Topography by Section

Section	Topography
1	The level of the existing A9 decreases from 239m AOD at the start of the section to 232m AOD at the end. In general, there is a decrease in elevation across the study area from the northwest towards Loch Alvie in the south east.
2	There is little change in elevation along the A9. The land comprises natural hillside to the northwest and low lying fields to the southeast – the existing A9 is located along a valley floor. There is a small water course, Allt-na-Criche in this section.
3a	To the east of the existing carriageway is predominantly flat, low lying ground that gently decreases in elevation towards the B9152. To the west of the A9 is steep, mountainous ground with Craigellachie Hill and the Monadhliath mountains beyond. The existing A9 generally follows the curve along the base of Craigellachie hill on the periphery of the valley floor to the east. The existing A9 corridor is accommodated through the creation of a large rock cut in the area of Kinakyle
3b	The existing A9 is situated on the lowermost flanks of Creag nan Gabhar – to the west of the carriageway the elevation increases into the increasingly mountainous region. To the east of the carriageway there is a slight decrease in elevation towards Aviemore.
4	The landscape in this section gently slopes down from the natural high land in the west to the east where the land is considerably flatter around the settlement of Aviemore.
5	There is a general decrease in elevation from the hilly western section of the study area to the low lying and more gently sloping land to the east. The existing A9 generally follows the contours along the lower level of the hillside.
6b	There is a general decrease in elevation from the mountainous area in the west to the flatter and in places hummocky land in the east of the study area. There is a slight increase in elevation of the existing carriageway from south (approximately 260m AOD) to north (approximately 277m AOD) in Section 6b.

Section	Topography
7	There is little change in elevation across this study area and it is at a consistent elevation of the order of 280m AOD throughout. A drumlin (a feature of glacial origin) is located to the west of the A9, situated between approximate Ch. 13200 and Ch. 13500.
8	In this section, the existing A9 is oriented north west to south east and crosses the River Dulnain and its low lying floodplain. The River Dulnain bridge has been given the identification number A9 1190 by Transport Scotland.
9	There is an increase in carriageway elevation from 300m AOD to 360m AOD across this section. The orientation of the A9 is southeast to northwest, becoming east to west. There is little variation in relief across much of section 9.
10	This section runs through an area known as Slochd that is characterised by natural, often steep hillsides to the north / north east of the existing carriageway and a general decrease in elevation towards the south / south west. There are a number of rock cuts along the existing carriageway in section 10 including some that have been subject to remedial works. At Ch. 21700 Slochd Beag Bridge carries the existing A9 over a narrow, steep sided valley through which a minor road and the Perth to Inverness Railway is routed. The railway is located in a rock cut and is crossed by the minor road.
11	In general, the land to the north east of the carriageway extends up into natural hillsides and there is typically a decrease in elevation from the existing A9 towards the south west. Further beyond, this land also rises into natural hillsides. In this section the A9 crosses Slochd Summit which is one of the highest points along the route from Perth to Inverness. There has been significant engineering works to facilitate the footprint of the existing A9 in this section with a large embankment partially infilling a natural hollow, and near vertical cuttings in rock. Additionally, the Perth to Inverness Railway line is in close proximity to the A9 in this area and, along with a rock cutting and natural slope, creates a pinch point in the scheme.

Climate

2.2.3. The climate in the study area is typical of the highlands with the average monthly temperature range between 15°C and -1°C while the annual rainfall is 977mm [Ref 2-1]. The route rises to 405 metres above sea level at Slochd Summit and due to its altitude and proximity to the Cairngorms mountain range, in winter months, the climate can also include significant snowfall leading on occasion to closure of the A9.

Land Use

2.2.4. The land use categories and classification adjacent to the A9 corridor are summarised per section within Table 2.2.2

Table 2.2.2: Adjacent Land Use, by section

Section	Land Use
1	Beyond the existing A9 corridor, land use throughout this section is mainly rough fields and natural hillside with a few agricultural fields towards the northern end. In general, to the north of the A9 is a mixture of moorland and agricultural land with areas of typically deciduous woodland. Loch Alvie (a Site of Special Scientific Interest) dominates the study area south of the A9 and is within 120m of the carriageway in places. The land use surrounding the loch typically comprises moorland, agricultural land, and woodland.
2	Outwith the existing A9 carriageway, the land use throughout this section is predominantly agricultural fields with sporadic sections of forestry.
3a	Aside from the existing A9 carriageway, land use is typically agricultural in the south of the section. Further north, Aviemore is located to the east of the A9 and includes residential and commercial development.
3b	The land use in section 3b predominately comprises forestry to the west of the carriageway along the entire section and also to the east at the most northern extent of the section. Aviemore is located to the east of the current A9 and includes residential and commercial development.
4	Outside of the existing A9 carriageway, the land use is a mix of forested land, small areas of agricultural land at the north end of Aviemore and commercial and residential development.
5	The land use in this section predominantly comprises a mixture of agricultural land and forestry.
6a	South east of the existing A9 carriageway, land use typically comprises agricultural fields with some forestry at the edge of the study area. The north western half of the study area is dominated by dense forestry.
6b	The land use in section 6b, beyond the existing A9 corridor, is predominantly forestry with some agricultural fields. Four small hamlets are located within the study area.
7	Beyond the existing A9 corridor, section 7 is dominated by extensive, dense forestry with a small number of open agricultural areas.

Section	Land Use
8	Outside the existing A9, current land use is mixed and principally comprises agricultural land with some forestry. Residential dwellings and commercial properties are also present. The remains of an industrial unit are present to the south west of the carriageway, south of the River Dulnain crossing. At the time of the walkover only the concrete base slabs of units and the remnants of waste associated with the demolition of the site were noted.
9	The eastern / south eastern half of the section, outside of the existing A9, is occupied by commercial forestry plantations that also extend along the northern margin of the study area. Towards the west of section 9, the land to the south of the carriageway becomes open moorland that is noted to be boggy in places.
10	Much of this section, outside of the A9 corridor, comprises natural heather-covered hillside. The slopes are typically steep and do not appear to be utilised for agricultural purposes. Slochd Cottages and the dwelling Rynaclarsach are located to the south west of the carriageway. National Cycle Route 7 runs throughout this section on the minor road that passes under the A9 Slochd Viaduct before becoming a designated cycle track north west of Rynaclarsach.
11	Most of the land within section 11 is moorland and barren hillsides. National Cycle Route 7 continues along the western side of the A9 in this section, between the existing A9 and the railway line. There are access tracks across the hillside on both side of the A9 and Grouse Butts; as identified on the Ordnance Survey maps, indicating that the land is used for shooting activities. Restrictions in place at the time of the walkover confirm that this area is used for field sports.

Railway Line

2.2.5. The Highland Mainline railway from Perth to Inverness is a single track line in the vicinity of the scheme. It runs south to north on the east side of the scheme at Dalraddy, from the southern limit of Aviemore, the railway passes to the east of the town whilst the A9 passes to the west. North of Aviemore the railway runs adjacent to the A9 on the east side, until it crosses underneath the A9 at Slochd Beag, from where it runs adjacent to the west side of the A9 in close proximity through the constrained corridor at Slochd Summit to the northern extent of the scheme.

2.3. Existing Road Network

Trunk Road

2.3.1. This section of the A9 Trunk Road is currently managed and maintained by Network Operator BEAR for Transport Scotland on behalf of the Scottish Ministers. The existing road is generally a single carriageway 7.3m wide with 0.7m hardstrips throughout this section of the scheme with the exception of a short section of Wide Single (2+1) (WS2+1) carriageway that provides northbound overtaking opportunities for approximately 1km. The existing road network is illustrated on Figure 2.1 of Volume 2 of this report.

Junctions

2.3.2. There are a number of key junctions located within this section of the A9 allowing links to adjacent trunk roads and local roads, as well as linking into the adjacent residential and tourist centre of Aviemore and outlying villages.

2.3.3. For the purposes of assessing the function of all the existing junctions and accesses they have been considered individually and categorised into a tier which was prescribed as part of the junction strategy within the PES report.

2.3.4. The individual junction tiers as set out in the PES are as follows:

- **Tier 1** – A and B Class Roads
- **Tier 2** – C and Unclassified Roads
- **Tier 3** – Private and Agricultural Access Roads

2.3.5. An overview on the location of the existing Tier 1 and Tier 2 junctions within the project extents are presented in Figure 2.3.1. Details on Tier 3 junctions are discussed separately within chapter 2.3.8 of this report.

2.3.6. Within the project extents, there is one junction which provides a direct trunk to trunk road connection. The junction is located at Granish to the north of Aviemore and links the A9 and A95 trunk roads.

2.3.7. The A95 (A9 to Charlestown of Aberlour) is a single carriageway road which runs from Granish through Grantown-on-Spey and continues on to Charlestown-of-Aberlour. The A95 forms a key route for business in the area, particularly with whisky production where much of it is transported to the Central Belt via the A9. East of Granish, the B9152 branches off from the A95 and runs due south to Aviemore town centre. This junction also provides access to Carrbridge from the South.

2.3.8. There are three number local roads that have direct junction connections with the A9 (See Figure 2.1 in Volume 2):

- The B9152 (Aviemore to Kincraig) runs from Kincraig north to Aviemore to the east of the existing A9 alignment. A spur connects the A9 to the B9152 opposite Lynwilg farm. The B9152 was the original A9 before the current alignment was constructed in the 1970s. The B9152 is a single carriageway approximately 7m wide with reasonable alignment. The B9152 also connects to the A9 north of Aviemore at Granish at the junction with the A95 noted above.

- The A938 (Black Mount to Grantown-on-Spey) runs from the A9 junction at Black Mount to Grantown-on-Spey, where it joins the A95. This road provides access to Carrbridge and further east to Dulnain Bridge and Grantown-on-Spey.

- The unclassified road from Black Mount which connects with the A9 immediately south of Slochd Summit

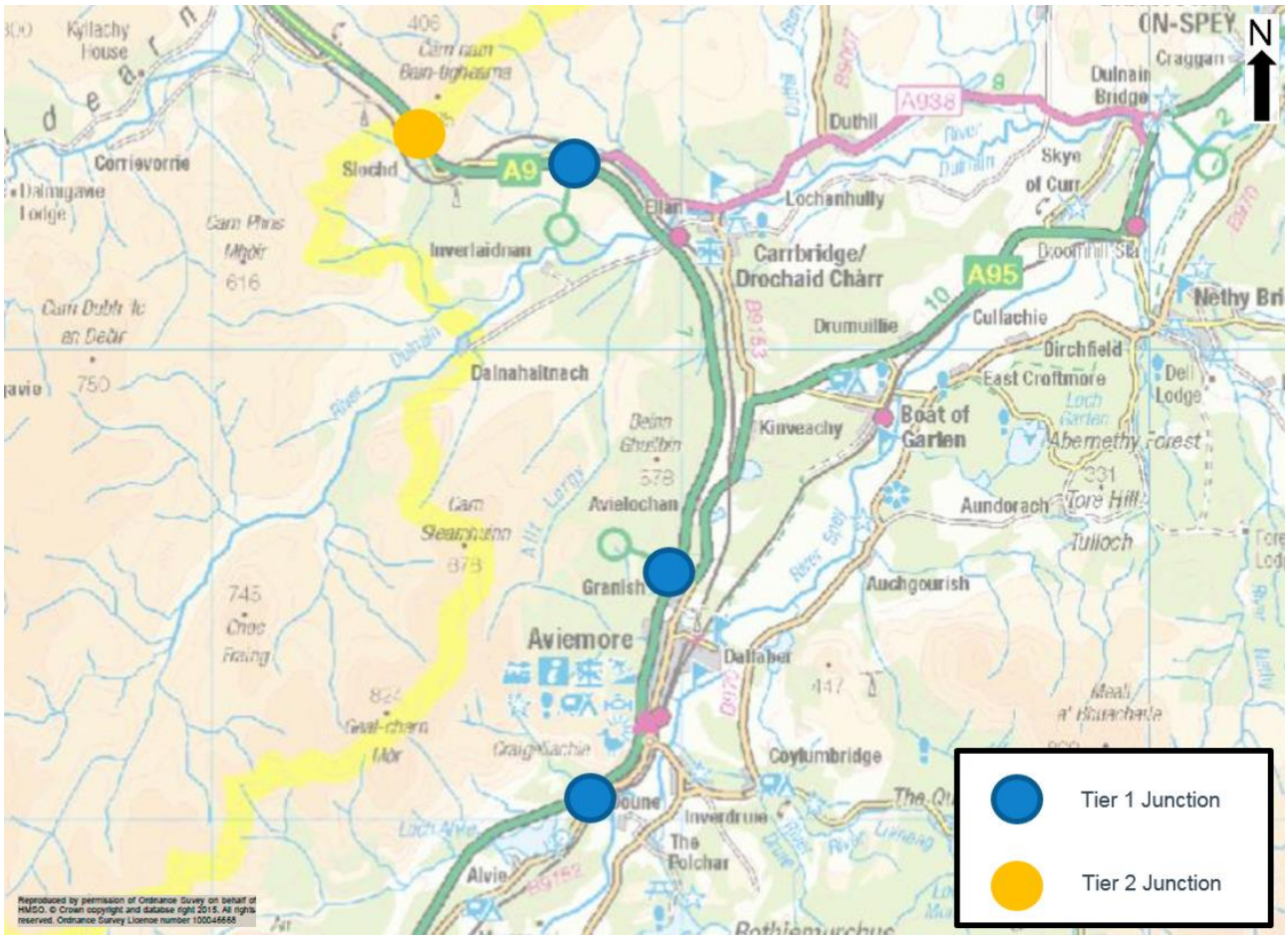

Figure 2.3.1 Existing Junctions – Tier 1 & 2

Existing Accesses

2.3.9. There are a total of 32No. accesses which fall under the category of a Tier 3 that directly join the A9 within the project extents. These consist of 18No. from the northbound direction carriageway and 14No. from the southbound direction carriageway as summarised in Table 2.3.1

Table 2.3.1: Existing Accesses

Chainage (m)	N-Bound	S-Bound	Access Details
2,200	✓	✓	Ballinluig access containing a gate with a surfaced approach road.
2,800	✓	✓	Field accesses containing gates with surfaced approach roads.
3,270	✓		Access to Lynwilg Farm with surfaced approach road and deceleration lane.
4,650	✓		Access to 5 No. residential properties with surfaced approach road and deceleration lane.
5,700	✓	✓	Access to Craigellachie Nature Reserve and MacDonald Highland Resort. Consultation with Aviemore and Vicinity Community Council suggests this is often used as a foot crossing to access the nature reserve. Surfaced approach roads and gated on both northbound and southbound sides.
8,450	✓		Field access containing a gate with an unsurfaced approach and full height kerb (no dropped kerb).
8780	✓		Field Access, appears unused.
9,200	✓	✓	Field accesses containing gates with surfaced approach roads.
10,530	✓	✓	Field accesses containing gates with surfaced approach roads. Access on the southbound side links to the A95.
12,140	✓	✓	Field accesses containing gates with surfaced approach roads. Access on the southbound side links under the Highland Mainline railway.
12,400	✓	✓	Access to Keeper's Cottage and Kinveachy Lodge on northbound side, and Gate House on southbound side. Southbound side links to the B9153 and A95 passing under the Highland Mainline railway. Both accesses contain a surfaced approach road.
13,250	✓	✓	Access to forestry land and Lethendryveole on northbound side. Access to B9153 on southbound side passing under the Highland Mainline railway. Both accesses contain a surfaced approach road.
13,800	✓	✓	Access to forestry land and Lethendryveole on northbound side. Access to B9153 on southbound side passing under the Highland Mainline railway. Both accesses contain a surfaced approach road. Gated only to the northbound access.
14,350	✓	✓	Access to forestry land on both north and southbound sides with gates and surfaced approach roads.
17,050	✓	✓	Access to Dalrachney Beag on northbound side, access to Carrbridge on southbound side. Both accesses contain a surfaced approach road. Gated only to the southbound access.
19,280	✓		Access to forestry land with a gate and a surfaced approach road.
21,010	✓	✓	Access to communications mast on Carn Bad nan Luibhean on northbound side and access to the NCN7 and the Highland Mainline railway on the southbound side. Both accesses contain surfaced approach roads.
21,900		✓	Access to Slochd Beag rock cut on southbound side via a surfaced approach road.
24,220	✓	✓	Access to grouse butts on southbound side and access to Highland Mainline railway and NCN7 on northbound side. Both accesses contain a surfaced approach road. Gated only to the southbound access.

2.3.10. It should be noted that there are existing junctions on the existing dualled section of the A9 adjacent to the scheme, specifically Tomatin South. The requirement, or otherwise, for these junctions is not being considered as part of this Stage 2 assessment. In the case of Tomatin South Junction, a full assessment will be undertaken at Stage 3 in consultation with the affected stakeholders and local community as part of the Tomatin to Moy project (A9 Project 12). However, as a minimum it is anticipated the existing central reserve opening will be closed at this location as the removal of such crossover junctions is a key safety feature of the proposed A9 Dualling Programme as a whole.

Drainage

2.3.11. The road drainage along this section of the A9 is a sealed positive system consisting of mainly kerbs, gullies and carrier pipes to the nearest watercourse.

2.3.12. There is no treatment of attenuation systems in place for the existing drainage network.

Watercourses

2.3.13. The Proposed Scheme is located within the catchment and associated sub-catchments of the River Spey. Within the study area there are several major tributaries of the River Spey, including the River Dulnain, the River Feshie and the River Druie, see Volume 2, Figure 2.2.

River Spey

2.3.14. The River Spey is the third longest river in Scotland, rising in the Corrieyairack Forest (south west of Newtonmore) at 350m AOD and flowing northeast to the Moray Firth. The river lies to the east of the A9 and runs to the east of Aviemore. North of Aviemore, the A9 and the Spey diverge, as the road turns west towards Slochd Summit, and the Spey continues towards the Moray Firth.

River Dulnain (Tributary of River Spey)

2.3.15. The River Dulnain rises in the Monadhliath Mountains. It flows northeast to the west of Kinveachy Forest. The Dulnain is crossed by the A9 at Carrbridge, NGR 2896 8225. The Dulnain is crossed by the Highland Mainline railway immediately to the east of the A9 alignment. The confluence of the Dulnain with the Spey is at Dulnain Bridge, NGR 3004 8237, outwith the area considered by the scheme.

Allt nan Ceatharnach (Tributary of River Dulnain)

2.3.16. Allt nan Ceatharnach is formed by the confluence of the Allt a'Bhainne and the Allt Ruighe Magaig in the Baddengorm woods to the north of the A9. Allt nan Ceatharnach is crossed by the A9 NGR 2891 8231, a structure known as Baddengorm Bridge. Allt nan Ceatharnach flows into the River Dulnain approximately 300m west of the River Dulnain Bridge.

Allt Chriochaidh

2.3.17. Allt Chriochaidh rises on the south eastern face of Geal-charn Mòr at a height of 740m AOD. Allt Chriochaidh is crossed by the A9 at NGR 2856 8095. Allt Chriochaidh outfalls into the western end of Loch Alvie. The A9 follows the north shore of Loch Alvie.

Allt na Chriche (Tributary of River Spey)

2.3.18. Allt na Chriche rises on the south eastern face of Geal-charn Beag (as Allt Dubh) and flows past Lynwilg Farm before being crossed by the A9, B9152 and the Highland Mainline in close succession. The A9 crossing is at NGR 2883 8106, and the outfall into the River Spey is at NGR 2884 8104. (NB: not to be confused with Allt na Criche, to the north of Aviemore)

Steallan Dubh (Tributary of Aviemore Burn)

2.3.19. Steallan Dubh rises at an altitude of 570m AOD on Carn Dearg Mòr and flows east through Craigellachie Nature Reserve. Steallan Dubh is crossed by the A9 immediately west of Aviemore at NGR 2893 8138. Steallan Dubh merges with Milton Burn to form Aviemore Burn, which flows parallel to the A9 in a southerly direction, and outfalls into the Spey at NGR 2898 8124.

Milton Burn (Tributary of Aviemore Burn)

2.3.20. Milton Burn rises at an altitude of 520m AOD on Carn Dearg Mòr and flows east through Craigellachie Nature Reserve. Milton Burn diverges, with one course joining Steallan Dubh, and the other continuing east. Milton Burn is crossed by the A9 immediately west of Aviemore at NGR 2893 8139. Milton Burn merges with Steallan Dubh to form Aviemore Burn, which flows parallel to the A9 in a southerly direction, and outfalls into the Spey at NGR 2898 8124.

Allt na Criche

2.3.21. Allt na Criche rises between Càrn Mòr and An Leth-chreag in the Monadhliath Mountains northwest of Aviemore. Allt na Criche is crossed by the A9 at NGR 2900 8156. Allt na Criche outfalls into Loch nan Carraigean, which appears not to have an outfall into any watercourse, although it may drain through the boggy ground between Loch nan Carraigean and the River Spey. (NB: not to be confused with Allt na Chriche, to the south of Aviemore)

Fèith Mhòr (Tributary of River Dulnain)

2.3.22. Fèith Mhòr rises in Kinveachy Forest to the west of the A9. Fèith Mhòr is crossed by the A9 at NGR 2907 8207. The Highland Mainline crosses Fèith Mhòr to the east of the A9. The confluence of the Dulnain and the Fèith Mhòr is at NGR 2942 8240, outwith the area considered in this study.

2.3.23. There are also a number of unnamed watercourses / drainage ditch networks, which are culverted beneath the existing A9.

2.4. Geotechnical

2.4.1. Information for the assessments has been gathered from available desk study information (Dalraddy to Slochd Preliminary Sources Study Report, and WebGIS), supplemented by field walkovers and consultation with statutory authorities. An overview of the consulted information is included in Table 2.4.1 while an overview of the consulted published reports is presented in Table 2.4.2.

2.4.2. A full discussion of the anticipated geotechnical conditions is presented in the Northern Section Dalraddy to Slochd Geotechnical Preliminary Sources Study Report (A9P11-AMJV-VGT-A_ZZZZZ_ZZ-RP-GE-0004) prepared by AtkinsMouchel JV. A summary of the anticipated geotechnical conditions is presented below and in Tables 2.5.1 through to 2.10.1. Reference should also be made to the following figures as contained in Volume 2:

- Figure 5.19: Mainline Option 1 - Exploratory Hole Location Plan and Geological Long Section
- Figure 5.20: Mainline Option 1A - Exploratory Hole Location Plan and Geological Long Section
- Figure 5.21: Mainline Option 2 - Exploratory Hole Location Plan and Geological Long Section
- Figure 5.22: Mainline Option 1 - Superficial Geological Conditions
- Figure 5.23: Mainline Option 1A - Superficial Geological Conditions
- Figure 5.24: Mainline Option 2 - Superficial Geological Conditions
- Figure 5.25: Mainline Option 1 - Solid Geological Conditions
- Figure 5.26: Mainline Option 1A - Solid Geological Conditions
- Figure 5.27: Mainline Option 2 - Solid Geological Conditions
- Figure 9.6: Location and Depth of Peat

Existing Ground Conditions

2.4.3. The geomorphology of the land within the study area can be broadly summarised as attributable to processes during the last glacial period when glaciers extended across the majority of Britain, although the Monadhliath range to the west of the site does not display the characteristics of alpine glaciations, instead the Monadhliath range is an open moorland with few ridges. Strathspey itself is a glaciated U-Shaped valley.

2.4.4. Made ground associated with the existing A9 construction, the development of the Perth to Inverness railway line, and areas of former urban development should be expected within the development corridor particularly along embankments and adjacent to existing structures and roads.

2.4.5. The superficial deposits underlying the site are reported to comprise:

- Peat: “mainly upland blanket accumulation of wet acidic, partially decomposed vegetation”.
- Alluvium: “mainly sand, gravel, silt and clay from the Quaternary period”.
- River Terrace Deposits: ‘Undifferentiated deposits of sand and gravel, locally with lenses of silt, clay or peat’.
- Glaciofluvial Sheet Deposits: ‘Sand and gravel locally with lenses of silt, clay and organic material from the Quaternary Period’.
- Glaciofluvial Ice-Contact Deposits: ‘Sand and gravel locally with lenses of silt, clay and organic material from the Quaternary Period’.
- Glacial Till: ‘Devensian Diamicton from the Quaternary Period and hummocky sand and gravel glacial deposits’.

2.4.6. The bedrock geology beneath the site is reported to comprise igneous and metamorphic rocks consisting of:

- Granite.
- Monzogranite.
- Tonalite and Granodiorite.
- Psammite.
- Psammite and Semipelite.
- Semipelite.
- Quartzite.

2.4.7. Available data and site reconnaissance indicates that bedrock is at or near the surface at a number of locations across the Dalraddy to Slochd scheme.

2.4.8. In addition to the dominant bedrock lithologies listed above, several minor igneous intrusions belonging to the North Britain Siluro-Devonian Calc-alkaline Dyke Suite are present along the existing A9.

2.4.9. A number of faults cross or are in close proximity to the Dalraddy to Slochd scheme.

Table 2.4.1: Information Consulted

Information Type	Title / Source
Topography	Ordnance Survey (OS) Maps including: OS Opendata OS Landranger Nairn & Forres Sheet 27, 1:50,000 scale (2013) OS Landranger Kingussie & Monadhliath Sheet 35, 1:50,000 scale (2011)
Geological Information	British Geological Survey (BGS) Geological Maps: 1:50,000 scale Sheet 74E (Aviemore, 1993) – Solid Sheet 74E (Aviemore, 2013) - Superficial Sheet 74W (Tomatin, 2004) – Solid and Drift 1:10,560 scale Inverness-shire Sheet 45 FS (1909) – Solid and Drift Inverness-shire Sheet 58 FS (1910) – Solid and Drift 1:10,000 scale Sheet NH81SE (1991) – Solid and Drift Sheet NH82NW (Tomatin, 1998) – Solid and Drift Sheet NH82SW (Insharn, 1998) – Solid and Drift British Geological Survey online GeoIndex.
Hydrology	Ordnance Survey Maps (as listed above) Scottish Environment Protection Agency (SEPA) Online Flood Map SEPA River Basin Management Plan, waterbody datasheets and interactive map BGS (SNIFFER) Vulnerability of Groundwater in the Uppermost Aquifer map (2004)
Hydrogeology	Envirocheck reports: • Report No. 42789796_1_1 (Dalraddy to Kinveachy) (2012) • Report No. 42789802_1_1 (Kinveachy to Slochd) (2012) • Report No. 42789793_1_1 (Slochd to Moy) (2012) BGS Hydrogeological Map of Scotland, Scale 1:625,000 (1988) BGS (SNIFFER) Vulnerability of Groundwater in the Uppermost Aquifer map (2004) SEPA Online Interactive viewer groundwater data sheets
Ground Investigation Information	Historical exploratory hole records obtained through the BGS GeoIndex website Peat Probing undertaken in support of the scheme
Mining and Quarrying	Envirocheck reports (historic maps) BGS Online GeoIndex The Coal Authority Valuation Office Agency (Mineral Valuer)
Historical Information	Envirocheck reports (historic maps) Zetica Unexploded Ordnance Map (North Scotland) Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) The Highland Council Scottish Natural Heritage (SNH) Cairngorms National Park (CNP)

Information Type	Title / Source
Contaminated Land	Envirocheck reports Scottish Natural Heritage (SNH) The Highland Council Cairngorms National Park (CNP) Scottish Environment Protection Agency (SEPA) Public Health England (UK Radon map)
Archaeology	Royal Commission on the Ancient and Historical Monuments of Scotland (RCHAMS) • PastMap Interactive Map • Canmore online database

Table 2.4.2: Reports Consulted

Report Name	Summary	Date
Jacobs, A9 Dualling Perth to Inverness – Geotechnical Preliminary Sources Study Report, Dalraddy to Kinveachy, Chainage 122500 to 136300m, B1557620/GEO/PSSR/09. Rev 3, October 2013.	Preliminary Sources Study Report forming part of the PES submission.	October 2013
Jacobs, A9 Dualling Perth to Inverness – Geotechnical Preliminary Sources Study Report, Kinveachy to Slochd, Chainage 136300 to 147200m, B1557620/GEO/PSSR/10. Rev 3, October 2013.	Preliminary Sources Study Report forming part of the PES submission.	October 2013
Jacobs, A9 Dualling Perth to Inverness – Geotechnical Preliminary Sources Study Report, Slochd to Moy, Chainage 147200 to 161200m, B1557620/GEO/PSSR/11. Rev 4, October 2013.	Preliminary Sources Study Report forming part of the PES submission.	October 2013
M9/A9 Edinburgh – Stirling – Thurso Trunk Road Improvement at Carrbridge	Factual report of the Ground Investigation for the WS2+1 scheme	September 2008
M9/A9 Edinburgh – Stirling – Thurso Trunk Road A9 Minor Improvement Scheme Slochd	Factual report of the Ground Investigation for the WS2+1 scheme	December 2008
CH2M Hill, A9 Dualling Programme, Strategic Environmental Assessment Scoping Report, Document No. TSSEA9/SR/01 Version 1.2	Environmental assessment for the Perth to Inverness route	June 2013
CH2M Hill, A9 Dualling Programme, Strategic Environmental Assessment, Environmental Report Addendum, Document No. TSSEA9/SR/02 Version 1.2	Addendum to the environmental assessment for the Perth to Inverness route	March 2014
Raeburn Drilling and Geotechnical Limited, A9 Dualling – Dalraddy to Slochd Preliminary Ground Investigation, Draft Report on Ground Investigation	Factual report summarising peat probing undertaken in support of the Stage 2 assessment	May 2016
AMJV, A9 Dualling Northern Section, Dalraddy to Slochd - Geotechnical Preliminary Sources Study Report, A9P11-AMJ-VGT-Z_ZZZ_ZZ-RP-GE-0004	Preliminary Sources Study Report	August 2016

Information Excluded from the Assessment

2.4.10. At the time of writing a selection of assessments in connection with scheme development were ongoing. As a consequence the following have been excluded from the Stage 2 assessments. These shall be completed as part of the Stage 3 assessments.

- Inspection and assessment of existing earthwork assets in accordance with DMRB Standard HD41/15 *Maintenance of Highway Geotechnical Assets*;
- Inspection and assessment of existing rock cutting assets in accordance with Scottish Roads Network Landslides Study (SRNLS) method;
- Assessment of impact and risk posed by hazards beyond the proposed construction footprint including but not limited to:
    - Debris flow
    - Slope instabilities - Landslides
    - Peat slides
    - Rockfall

2.5. Mainline Option 1

2.5.1. A summary and discussion of the issues affecting the proposed Mainline Option 1 are presented in Table 2.5.1.

Table 2.5.1: Mainline Option 1- Existing geological conditions along the line of southbound widening

Section	Summary
Section 1 CH0 – 2500m Kincraig-Dalraddy tie-in to northern-most extent of Loch Alvie	***Geological Conditions*** From CH200 – 1650m the superficial deposits are reported to comprise Glaciofluvial sheet deposits. From CH1750 – 2500m the recorded superficial deposits are River Terrace Deposits (Undifferentiated). A localised area of Hummocky (Moundy) Glacial Deposits is noted to the north of the road between CH900 – 1500m. Peat deposits are not marked on available maps. However, completed peat probing between CH600 – 1400m records peat depths of up to 0.6m bgl in this section, to the north of the road. Alluvium is recorded to underlie the route from CH0 – 200m, and CH1600 –1750m. Additionally, Alluvial Fan Deposits are recorded from CH500 – 600m. Made Ground associated with the construction of the existing A9 and other urbanisation can be expected along the entire length of Section 1. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between ground level and 3.8m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Infilled quarries • Peat deposits • Soft clays and silts (Alluvium)

Section	Summary
	• High groundwater table • Presence of boulders and obstructions in superficial deposits • Local Instability of existing earthworks slopes • Flooding A disused gravel pit is located to the north of the scheme at CH2200 – 2300m. The backfill conditions are unknown and potentially contain variable fill. The projected extents of the quarry are beyond the proposed earthworks footprint. Local areas of instability are reported at CH1690m and 1900m on the southbound carriage. Between CH0 – 700m and at CH1600m the proposed southbound earthworks are anticipated to be within the extents of a 1:200 year flood event.
Section 2 CH2500 – 3500m Northernmost extent of Loch Alvie to Allt na Criche watercourse	***Geological Conditions*** Section 2 is reported to comprise River Terrace Deposits (Undifferentiated). Made Ground associated with the construction of the existing A9, the railway and other urbanisation can be expected along the entire length of Section 2. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between ground level and 4.4m bgl. ***Potential Geotechnical Hazards*** • Made Ground • High groundwater table • Presence of boulders and obstructions in superficial deposits
Section 3a CH3500 – 5500m Allt na Criche to north of Loch Puladdern	***Geological Conditions*** Superficial deposits across Section 3a are reported to primarily consist of Glaciofluvial Sheet Deposits with River Terrace Deposits (Undifferentiated) between CH3500 – 3650m and CH4000 – 4200m. Bedrock is very close to or at the surface along the northbound carriage. Made Ground associated with the construction of the existing A9, the railway and other urbanisation can be expected along the entire length of Section 3a. Site walkovers have shown bedrock to be at surface at a number of locations along Section 3a, typically exposed in cuttings formed as part of the A9 construction. Possible rockhead has been encountered in a number of historical shallow exploratory holes, typically at less than 5.0m bgl. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between 2.0m and 4.8m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Infilled quarries • Potential historical borrow pit

Section	Summary
	• High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Flooding A disused quarry is located at CH3800 – 3850m, which could potentially contain variable fill. The projected extents of the quarry are beyond the proposed earthworks footprint. At CH3800m an area of Made Ground is noted. Anecdotal evidence suggests that this may represent a former borrow pit associated with the original A9 construction. Potential for rockfall instability observed in the vicinity of Craigellachie National Nature Reserve to the west of the A9. At CH3500m the proposed earthworks are anticipated to be within the extents of a 1:200 year flood event.
Section 3b CH5500 – 6700m North of Loch Puladdern to northern extent of Craigellachie NNR	***Geological Conditions*** Superficial deposits across Section 3b are reported primarily to consist Glaciofluvial Sheet Deposits. Hummocky (Moundy) Glacial Deposits may also underlie the alignment in isolated locations with reported occurrences in the vicinity of CH6050m and CH6600 – 6700m. Made Ground associated with the construction of the existing A9 and other urbanisation can be expected along the entire length of Section 3b. Site walkovers have confirmed bedrock to be at surface at a number of locations along Section 3b, typically exposed in cuttings formed as part of the A9 construction. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between 1.45m and 6.8m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Shallow groundwater • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings Potential for rockfall instability observed in the vicinity of Craigellachie National Nature Reserve to the west of the A9.
Section 4 CH6700 – 7900m Northern extent of Craigellachie NNR to Granish Farm	***Geological Conditions*** Superficial deposits across Section 4 are reported to primarily consist Glaciofluvial Sheet Deposits. Hummocky (Moundy) Glacial Deposits may also underlie the alignment between CH6900 – 7050m and CH7500 – 7900m. Made Ground associated with the construction of the existing A9 can be expected along the full length of Section 4. A disused quarry or gravel pit is located at CH 7800 – 7900m, which could potentially contain variable fill.

Section	Summary
	Peat deposits are not marked on maps, however completed peat probing record peat depths of up to 0.9m bgl. Site walkovers have confirmed bedrock to be at surface at a number of locations, typically exposed in cuttings formed as part of the A9 construction. Possible bedrock was encountered in historical exploratory holes at depths from 1.75m to 5.9m bgl. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between 0.25m and 5.15m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Infilled Quarries • Peat deposits • Shallow groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Flooding A disused quarry or gravel pit is located at CH7800 – 7900m, which could potentially contain variable fill. As proposed the earthworks cutting is required to be formed within the footprint of the quarry. At CH7200m the proposed earthworks are anticipated to be within the extents of a 1:200 year flood event.
Section 5 CH7900 – 10400m Granish Farm to Avielochan **(Includes Granish Junction)**	***Geological Conditions*** Within Section 5 the reported superficial deposits consist of Glaciofluvial Sheet Deposits, Hummocky (Moundy) Glacial Deposits, and Glacial Till of Devensian age. The approximate extents of where dominant soil type beneath the A9 alignment is outlined as follows: • CH 7900 – 8000m – Hummocky (Moundy) Glacial Deposits • CH 8000 – 9100m – Glaciofluvial Sheet Deposits • CH 9100 – 9200m – Hummocky (Moundy) Glacial Deposits • CH 9200 – 9400m – Glacial Till (Devensian) • CH 9100 –10400 – Hummocky (Moundy) Glacial Deposits Made Ground associated with the construction of the existing A9 can be expected along the full length of Section 5. Peat deposits are not noted on published maps, however, peat probing in this area indicates peat depths of up to 0.9m bgl to be present between CH8800 – 9100m. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between ground level and 5.35m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Infilled Quarries • Peat deposits • High groundwater table

Section	Summary
	• Presence of boulders and obstructions in superficial deposits Disused quarries / gravel pits are recorded at CH7900 – 8100m, and at CH8400 – 8600m, which could potentially contain variable fill. As proposed the earthworks cutting is required to be formed within the footprint of the quarries.
Section 6a CH10400 – 11700m Avielochan to south of Kinveachy	***General superficial geology*** Within Section 6a the superficial deposits are reported to consist of Glaciofluvial Sheet Deposits. Hummocky (Moundy) Glacial Deposits are reported between CH10400 – 10750m, and Glacial Till (Devensian) between CH11300 – 11700m. Bedrock is reported very close to or at the surface from CH10700 – 10800 m and from CH11600 – 11700m. Made Ground associated with the construction of the existing A9 and areas of urbanisation can be expected along the full length of Section 6a. ***Groundwater Conditions*** Historical boreholes (pre-date A9 construction) record groundwater at shallow depths between ground level and 3.9m bgl. However, limited historical information is available across the section. ***Potential Geotechnical Hazards*** • Made Ground • Shallow groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Waterbodies Potential for rockfall instability in the rock cuts to the west of the A9. Inland ponds are present below the southbound carriage at approximately CH 10700m, 11200m and 11400m which the proposed earthworks will be required to overfill.
Section 6b CH11700 –13000m South of Kinveachy to north of Knock of Kinveachy	***General superficial geology*** Within Section 6b the reported superficial deposits dominantly consist of Glaciofluvial Sheet Deposits between CH11700 – 12250m and CH12700 – 13000m; and Glacial Till (Devensian) between CH12250 – 12700m. Bedrock is likely to be close to surface in the vicinity of CH11700 – 11800m. Made Ground associated with the construction of the existing A9 and other urban activities should be anticipated along the full length of Section 6b. ***Groundwater*** No boreholes to provide information. ***Potential Geotechnical Hazards*** • Made Ground • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Waterbodies

Section	Summary
	An inland ponds is present below the southbound carriage at approximately CH12720m, which the proposed earthworks will be required to overfill.
Section 7 CH13000 – 16300m North of Knock of Kinveachy to Carrbridge	***General superficial geology*** Within Section 7 the dominant superficial deposits are reported to consist of Glaciofluvial Ice Contact Deposits (CH13000 – 14050m), Glacial Till (CH14300 – 14550m), and Hummocky (Moundy) Glacial deposits (CH14550 – 16300m). Alluvium is likely to be present between CH14500 – 14600m while bedrock is very close to or at the surface from CH14050 – 14300m. Peat is indicated to be present on existing maps to the north of the route between CH13200 – 13300m and CH15000 – 16100m. Peat probing results suggest peat is more widespread than reported with peat depths of up to 4.3m bgl recorded. Made Ground associated with the construction of the existing A9 can be expected along the full length of Section 7. ***Groundwater*** Historical boreholes (associated with the Carrbridge WS2+1 scheme) record groundwater at shallow depths between 1.2m and 9.5m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Peat • Soft clays and silts (Alluvium) • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Flooding Potential for rockfall instability in the existing rock cuts observed. At CH14500m the proposed earthworks are anticipated to be within the extents of a 1:200 year flood event.
Section 8 CH16300 – 17600m Carrbridge to Baddengorm Woods	***General superficial geology*** Within Section 8, the reported dominant superficial deposits consist of Hummocky (Moundy) Glacial Deposits (CH16300 – 16600m; CH17000 – 17600m) and River Terrace Deposits (Undifferentiated) (CH16800 – 17000m). Locally, Glaciofluvial Sheet Deposits are recorded to be present in the vicinity of CH16600m. Extensive Alluvium deposits are present between CH16600 – 16800m and CH17300 –17400m, likely associated with the River Dulnain, other watercourses, and their floodplains in this section. Peat probing indicates that peat or soft ground is present to a depth of up to 0.3 m bgl. Made Ground associated with the construction of the existing A9 and other areas of urbanisation can be expected along the full length of Section 8.

Section	Summary
	Groundwater A single historical borehole is available with Section 8. The borehole does not record groundwater. ***Potential Geotechnical Hazards*** • Made Ground • Peat • Soft clays and silts (Alluvium) • High groundwater table • Presence of boulders and obstructions in superficial deposits • Flooding Local areas of instability are reported at CH16700m, 17200m and 17450m. Between CH16600m – 16700m and 17300 – 17500m the proposed earthworks are anticipated to be within the extents of a 1:200 year flood event.
Section 9 CH17600 – 20900m Baddengorm Woods to east of An Slochd Beag **(Includes Black Mount Junction)**	***General superficial geology*** Within Section 9, the route is reported to be underlain primarily by Hummocky (Moundy) Glacial Deposits. Peat is reported to underlie the scheme between CH19800 and 20900m. Made Ground associated with the construction of the existing A9 and other areas of urbanisation can be expected along the full length of Section 9. Site walkovers confirmed the presence of large areas of peatland. Subsequent peat probing has encountered peat or soft ground to depths of up to 5.4m bgl. Historical boreholes record the potential presence of shallow bedrock. ***Groundwater*** Historical boreholes (associated with the Slochd WS2+1 scheme) record groundwater at shallow depths between 2.0m and 10.0m bgl. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock
Section 10 CH20900 – 23100m East of An Slochd Beag to south of Slochd summit	***General superficial geology*** Within Section 10, the route is reported to be underlain primarily by Hummocky (Moundy) Glacial Deposits and Glaciofluvial Sheet Deposits. Bedrock is at or near surface throughout much of Section 10 as evidenced from the site walkover and historical boreholes Made Ground associated with the construction of the existing A9 can be expected across Section 10. ***Groundwater*** Historical boreholes (associated with the Slochd WS2+1 scheme) record groundwater at shallow depths between 1.0m and 8.0m bgl.

Section	Summary
	Summary Potential Geotechnical Hazards • Made Ground • Infilled quarries • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuts • Weathered bedrock Potential for rockfall instability in the existing rock cuts. Local areas of instability are reported between CH22800m, 23050 adjacent to the northbound carriage. Disused quarries are located to the south of the road at CH22000 – 22100m, and to the north of the road at CH22750 – 22800m, which could potentially contain variable fill.
Section 11 CH23100 – 25030m South of Slochd summit to tie-in with existing dual carriageway north of Slochd	***General superficial geology*** The route is reported to be underlain primarily by Glacial Till. Additionally Glaciofluvial Sheet Deposits are likely to be present between CH23100 – 23400m. Peat is reported to underlie the route between approximately CH24500 – 25030m. Anecdotal evidence suggests that up to 5.0m of peat was excavated to the northwest of Slochd Summit when the original A9 was constructed. Peat probing undertaken in this section indicates peat depths up to a maximum of 2.5m bgl between CH24000 – 24300m. Bedrock is at or near surface throughout much of this section as shown on the geological maps and evidenced from the walkover. Made Ground associated with the construction of the existing A9 should be anticipated throughout much of Section 11. ***Groundwater*** There are no available historical boreholes to inform groundwater assessment. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuts • Slope instabilities • Geological Conservation Review site Potential for rockfall instability in the existing rock cuts. The works are to be undertaken within the Slochd Geotechnical Conservation Review site. The proposed earthworks are required to above a substantial natural depression at Slochd Mòr which also exhibits signs of slope instabilities.

2.6. Mainline Option 1A

2.6.1. A summary of the issues affecting the proposed Mainline Option 1A is presented in Table 2.6.1. Please note that discussion of Sections 2, 3a and 3b only are presented as the remaining Sections are concurrent with Option 1. For discussion of the remaining sections please refer to Table 2.5.1 above.

Table 2.6.1: Mainline Option 1A - Existing geological conditions along the line of southbound widening with adjustment at Kinakyle and Lag na Cailich

Section	Summary
Section 2 *CH2500 – 3500m* *Northernmost extent of Loch Alvie to Allt na Criche watercourse*	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • High groundwater table • Presence of boulders and obstructions in superficial deposits
Section 3a *CH3500 – 5500m* *Allt na Criche to north of Loch Puladdern*	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Potential historical borrow pit • High groundwater table • Presence of boulders and obstructions in superficial deposits • Existing rock cuttings • Flooding
Section 3b *CH5500 – 6700m* *North of Loch Puladdern to northern extent of Craigellachie NNR*	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Shallow groundwater • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Rock slope instabilities

2.7. Mainline Option 2

2.7.1. A summary of the issues affecting the proposed Mainline Option 2 is presented in Table 2.7.1.

Table 2.7.1: Mainline Option 2 - Existing geological conditions along the line of northbound widening

Section	Summary
Section 1 CH0 – CH2500m Kincraig-Dalraddy tie-in to northern-most extent of Loch Alvie	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Infill Quarries • Peat deposits • High groundwater table • Soft clays and silts (Alluvium) • Presence of boulders and obstructions in superficial deposits • Local Instability of existing earthworks slopes • Flooding A disused gravel pit is located to the north of the scheme at CH2200 – 2300m. The backfill conditions are unknown and potentially contain variable fill. The projected extents of the quarry are beyond the proposed earthworks footprint. However, it is noted that the proposed earthworks are closer to the quarry than Option 1. Local areas of instability are reported at CH1690m and 1900m on the southbound carriage.
Section 2 CH2500 – 3500m Northernmost extent of Loch Alvie to Allt na Criche watercourse	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • High groundwater table • Presence of boulders and obstructions in superficial deposits
Section 3a CH3500 – 5500m Allt na Criche to north of Loch Puladdern	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground

Section	Summary
	• Infilled Quarries • High groundwater table • Presence of boulders and obstructions in superficial deposits • Existing waterbodies • Existing rock cuttings • Flooding As noted in Table 2-1 a disused quarry is located at CH3800 – 3850m, which could potentially contain variable fill. In comparison to Option 1 the projected extents of the quarry now impact on the proposed earthworks footprint. As per Option 1, potential for rockfall instability in the vicinity of Craigellachie National Nature Reserve to the west of the A9 exists. With northbound widening the proposed alignment moves closer to this hazard, potentially increasing the risk posed by rockfall. Similarly, more extensive rock cuttings will be required. Particular reference of such instances are CH 3700 - CH 3900m and CH 4400 – CH 4500m. Loch Puladdern is located on the northbound carriage at approximately CH 5400m which the proposed earthworks will be required to overfill.
Section 3b CH5500 – 6700m North of Loch Puladdern to northern extent of Craigellachie NNR	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings In addition to the potential risks outlined in Table 2-1 it is likely that with extended northbound widening, more extensive rock cuttings will be required. Similarly, the risk posed by rock slides will be greater when compared against Option 1 on account of increased proximity to the hazards.
Section 4 CH6700 – 7900m Northern extent of Craigellachie NNR to Granish Farm	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Infilled Quarries • Peat deposits • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock

Section	Summary
	• Flooding A disused quarry or gravel pit is located at CH7800 – 7900m, which could potentially contain variable fill. As proposed the earthworks cutting is required to be formed within the footprint of the quarry. In comparison to Option 1 the proposed earthworks footprint cutting does not extend as far into the anticipated quarry extents. In addition to the potential risks outlined in Table 2-1 it is likely that with extended northbound widening, more extensive rock cuttings will be required, particularly between CH 7600 – CH 7900m.
Section 5 CH7900 – 10400m Granish Farm to Avielochan **(Includes Granish Junction)**	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Summary Potential Geotechnical Hazards*** • Made Ground • Infilled Quarries • Peat deposits • High groundwater table • Presence of boulders and obstructions in superficial deposits Disused quarries/gravel pits are recorded at CH7900 – 8100m, and at CH8400 – 8600m, which could potentially contain variable fill. As proposed the earthworks cutting is required to be formed within the footprint of the quarries. In comparison to Option 1 the proposed earthworks footprint cutting does not extend as far into the anticipated quarry extents CH7900 – 8100m. At CH8400 – 8600m the risk posed by the former remains the same.
Section 6a CH10400 – 11700m Avielochan to south of Kinveachy	***Geological Conditions*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Shallow Groundwater • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Waterbodies ***Discussion of Potential Geotechnical Risks to Engineering Solution*** As per Option 1, potential for rockfall instability. With northbound widening the proposed alignment moves closer to this hazard, potentially increasing the risk posed by rockfall. In addition it is likely that with extended northbound widening more extensive rock cuttings will be required in proximity of CH 10800m.

Section	Summary
	Inland ponds are present below the southbound carriage at approximately CH 10700m, 11200m and 11400m which the proposed earthworks will be required to overfill.
Section 6b CH11700 –13000m South of Kinveachy to north of Knock of Kinveachy	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Waterbodies An inland ponds is present below the southbound carriage at approximately CH 12720m, which the proposed earthworks will be required to overfill.
Section 7 CH13000 – 16300 North of Knock of Kinveachy to Carrbridge	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Flooding In addition to the potential risks outlined in Table 2-1 it is likely that with extended northbound widening, more extensive rock cuttings will be required in proximity of CH 14050 –14300m. In comparison against the potential risks outlined in Table 2-1 the northbound alignment does not impact on the conjectured extents of alluvium.
Section 8 CH16300 – 17600m Carrbridge to Baddengorm Woods	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground

Section	Summary
	• Peat • Soft clays and silts (Alluvium) • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Existing rock cuttings • Flooding
Section 9 CH17600 – 20900m Baddengorm Woods to east of An Slochd Beag **(Includes Black Mount Junction)**	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits
Section 10 CH20900 – 23100m East of An Slochd Beag to south of Slochd summit	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Weathered bedrock
Section 11 CH23100 – 25030m South of Slochd summit to tie-in with existing dual carriageway north of Slochd	***General superficial geology*** Refer to Table 2.5.1. ***Groundwater Conditions*** Refer to Table 2.5.1. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Shallow bedrock • Presence of boulders and obstructions in superficial deposits • Shallow bedrock • Slope instabilities

2.8. Aviemore South Junction

2.8.1. A summary of the issues affecting the proposed Aviemore South Junction options are presented in Table 2.8.1. On account of conditions being common to all junction options a global discussion is presented with local variances highlighted where appropriate.

Table 2.8.1: Existing geological conditions at the location of the proposed Aviemore South Junction. Alignment – Options A02, A09, A18

Applicable Mainline Options	Junction Option	Summary
Option 1, 2 and 1A	A02 A09 A18	***Geological Conditions*** Ground conditions are reported to comprise River Terrace Deposits (Undifferentiated) which are anticipated to comprise dense to very dense sand and gravel with high cobble and boulder content. Historical boreholes indicate the presence of peat up to 3.8m bgl near the location of the proposed structure. It is assumed these materials will have been excavated and replaced with a suitable engineered fill material. However, further deposits outside the existing A9 are likely to be present. Soft alluvial deposits associated with the existing watercourse may be present. Made Ground associated with the construction of the existing A9, the railway and other urbanisation can be expected along the entire junction footprint. ***Groundwater*** Historical boreholes (pre-date A9 construction) indicate a high water table. ***Potential Geotechnical Hazards*** • Made Ground • Infilled quarries / Borrow pits • Peat • Soft clays and silts (Alluvium) • Shallow Groundwater • Presence of boulders and obstructions in superficial deposits Locally disused pits are recorded but are not conjectured to be within the footprint of the proposed junction. Made Ground is reported locally below the existing A9 at the current B9152 connection to the A9. It is understood that the area may be attributed to a former borrow pit used to construct the original A9. This affects option A18 only.

2.9. Granish Junction

2.9.1. A summary of the issues affecting the proposed Granish Junction options are presented in Table 2.9.1. On account of conditions being common to all junction options a global discussion is presented with local variances highlighted where appropriate.

Table 2.9.1: Existing geological conditions at the location of the proposed Aviemore South Junction. Alignment – Options C31, C34, C18, C21

Applicable Mainline Options	Junction Option	Summary
Option 1, 2 and 1A	C31 C34 C18 C21	***Geological Conditions*** Ground conditions are anticipated to comprise dense to very dense Glaciofluvial or Glacial till sand and gravel with high cobble and boulder content. Recent probing records shallow peat on the north merge typically up to 0.5m deep. Soft alluvial deposits associated with the existing watercourse may be present. Made Ground associated with the construction of the existing A9, the railway and other urbanisation can be expected along the entire junction footprint. ***Groundwater*** Historical boreholes (pre-date A9 construction) do not record groundwater. ***Potential Geotechnical Hazards*** • Made Ground • Infilled quarries • Soft clays and silts (Alluvium) • High groundwater table • Presence of boulders and obstructions in superficial deposits • Waterbodies Locally a former quarry is recorded at the north diverge and south merge. The Allt na Criche watercourse is present at the top of the proposed northbound diverge cutting directly impacting on options C18, C21, C31, and C34. This may require local realignment to mitigate risk to proposed earthworks. Option C21 and C34 interface with the existing cutting and appropriate grading will be required.

2.10. Black Mount Junction

2.10.1. A summary of the issues affecting the proposed Black Mount Junction options are presented in Table 2.10.1. On account of conditions being common to all junction options a global discussion is presented with local variances highlighted where appropriate.

Table 2.10.1: Existing geological conditions at the location of the proposed Black Mount Junction. Alignment Options – D02, D03, D07 D12, D13, D51

Applicable Mainline Options	Junction Option	Summary
Option 1, 2 and 1A	D02 D03 D07 D12 D13 D51	***General superficial geology*** The junction is reported to be underlain primarily by Hummocky (Moundy) Glacial Deposits of dense to very dense sand and gravel with high cobble and boulder content. Peat is reported to underlie the scheme between CH19800 and 20900m. Site investigations has encountered peat or soft ground to depths of up to 1.5m bgl. Made Ground associated with the construction of the existing A9. ***Groundwater*** Historical boreholes record groundwater at shallow depth. ***Potential Geotechnical Hazards*** • Made Ground • Peat • High groundwater table • Presence of boulders and obstructions in superficial deposits It is noted that Options D12 and D51 have a larger footprint and as a consequence would require increased excavation of peat deposits. Furthermore, the extended footprints further impact upon the existing cutting which may require additional design requirements.

2.11. Structures

2.11.1. Along this section of the A9 there are 13 no. bridges, 29 no. culverts, 3 no. livestock creeps and 2 no. sign gantries recorded following site visits as shown in Table 2.11.1, see Volume 2, Figure 2.3. It should be noted that 4 No. culverts to the north of Slochd are recorded as footbridges in some sources, as they carry a culverted flow beneath a non-motorised user route.

Table 2.11.1: Existing Structures (listed from south to north)

Structure Code	Structure Name	Diam.	Easting	Northing	Comments
A9 1100	Allt Chriochaidh	Span 4m, width 13.2m	285671	809530	Reinforced concrete box over watercourse
A9 1100 C69	Loch Alvie Creep	2m	286477	809994	Livestock creep
A9 1100 C70	Caochan Burn	2.1m	286645	810088	
A9 1100 G85	VMS/A14 Aviemore	2.5m, 0.5m dia. Post with 2.5m x 5.8m sign	287573	810315	Variable Message Sign on single column
A9 1110 C10	Ballinluig Burn	2.3m	286866	810179	
A9 1110	Ballinluig Pedes U/P	3.8m	286857	810176	Corrugated Steel underpass
A9 1120	Lynwilg U/P	3.7m	287624	810301	Corrugated Steel underpass
A9 1120 C19	Lynwilg Farm	0.85m	287870	810350	
A9 1130	Criche	Height to soffit 3.5m approx., total length 22.1m, span approx. 6m	288357	810590	Bridge over burn, water too fast moving for access under the bridge.
A9 1130 C54	Kinakyle		-	-	There is very little existing information on Kinakyle culvert.
A9 1130 G88	VMS Aviemore (B9152)		289189	811474	Sign Gantry
A9 1140	Craig Dhu U/P	3.8m	289200	811500	Corrugated Steel underpass
A9 1150	Craigellachie Nr U/P	4m	289100	812000	Corrugated Steel underpass
A9 1150 C7	-	0.9m	289082	812595	Small diameter culvert draining Loch Puladdern, under the existing A9 to the east.
A9 1150 C49	-	0.6m	289203	813032	
A9 1150 C25	-	0.9m	289280	814605	

Structure Code	Structure Name	Diam.	Easting	Northing	Comments
A9 1150 C87	Milton Sheep Creep	1.9m	289270	813700	Livestock creep, possibly used as human access by public.
A9 1160	Milton Caravan Site	Span 5.7m, kerb to kerb 5.2m	289400	813900	Corrugated Steel underpass
A9 1162	High Burnside U/P	Height to soffit 5.5m, span 9m, total length 31m	289385	814042	Integral reinforced concrete underpass
A9 1150 C11	Culvert 01	0.9m Dia.	289457	814205	Recorded during site visit as Culvert 01
A9 1150 C95	Steallan Dubh	2m Dia.	289320	813850	
A9 1170	Granish U/P	3.7m	289673	814718	Corrugated Steel underpass
A9 1170 C4	Granish	0.7m	289905	815185	
A9 1170 C6	Shunem	0.3m	289955	815260	Drain
A9 1170 C12	Allt Na Criche	1.8m	290081	815660	
A9 1170 C18	Avielochan 1	1m	290205	816295	
A9 1170 C20	Avielochan 2	1.5m	290242	816447	
A9 1170 C22	Avielochan 3	0.9m	290225	816400	
A9 1170 C23	Avielochan 4	1m	290305	816637	
A9 1170 C26	Avielochan 5	1m	290455	816905	
A9 1170 C32	Laggantygowan Creep	2.2m	290874	817531	Livestock creep
Culvert 02	Allt Cnapach	1.6m Dia.	291023	818518	Culvert added post site visit – Allt Cnapach watercourse is crossed
A9 1170 C53	Kinveachy Kennels	0.9m	291075	818935	
A9 1170 C75	Fèith Mhòr	2.1m Dia.	290760	820721	
A9 1170 C77	Crannaich 1	1.6m	290705	820867	
A9 1170 C81	Crannaich 2	1m	290637	821030	
A9 1180	Carrbridge U/P	Height to soffit 4.4m, width 13.2m, wingwall length 9.6m	289708	822488	Integral reinforced concrete underpass
A9 1190	Dulnain	Height to soffit 17m, beam depth 1.56m,	289600	822500	3-span bridge with weathered steel girders acting compositely with

Structure Code	Structure Name	Diam.	Easting	Northing	Comments
		girder spacing 3.1m, stiffener spacing 1.95m, Pier width 3.1m, span 25,34.3,23 m, width 13.2m			insitu deck and RC piers spanning flowing water.
A9 1200	Baddengorm	Skew span 13.7m, width 13.2m, Skew 40^{O}	289117	823152	Integral reinforced concrete bridge spanning flowing water
A9 1206 F	Slochd Summit 2 F/B	Height to soffit 1.7m, span 2m	284057	824933	Footbridge – Culvert under footpath adjacent to A9 mainline
A9 1207 F	Slochd Summit 3 F/B	Height to soffit 1.7m, span 3m	283743	825386	Footbridge – Culvert under footpath adjacent to A9 mainline
A9 1208 F	Slochd Summit 4 F/B	Height to soffit 1.6m, span 1.5m	283598	825516	Footbridge – Culvert under footpath adjacent to A9 mainline
A9 1209 F	Slochd Summit 5 F/B	Height to soffit 2m, span 1.2m	283446	825681	Footbridge – Culvert under footpath adjacent to A9 mainline
A9 1210	Slochd Beag	Span 40,65,40m , width 13.2	285185	823885	3-span bridge with weathered steel girders acting compositely with insitu deck and RC piers spanning a railway line and NMU route.
A9 1210 C31	Slochd Mhuic	Height to soffit 2.5m, width 1.5m, length 9.4m	284085	824987	
A9 1210 C39	Slochd Mòr 1	Height to soffit 3m, span 2.2m	280772	825375	
A9 1210 C45	Slochd Mòr 2	1.7m Dia.	283540	825610	
A9 1210 C46	Slochd Mòr 3	1.8m Dia.	283485	825670	

Bridges

Allt Chriochaidh Underbridge (A9 1100)

Description

2.11.2. Located approximately 5km south west of Aviemore, the bridge carries the A9 over a watercourse (Ch. 960). It was constructed circa 1982 and is a single span of reinforced concrete box construction. The bridge is square with a clear span of 4.0m. The deck is 13.2m wide with raised verges 1.8m wide at each edge. Aluminium P2 parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.1 Allt Chriochaidh Underbridge

Review against current standards

2.11.3. The cross section of this bridge does not meet the current standards required for a single carriageway. The hard strip width of 0.7m does not meet the requirement of 1.0m, but the overall width to back of verges is more than adequate. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verge width of 1.8m does satisfy the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05.

2.11.4. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. The current bridge deck could be utilised with modification of the kerb lines to achieve the current cross section standard.

2.11.5. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Ballinluig Pedestrian Underpass (A9 1110)

Description

2.11.6. Located approximately 4km south west of Aviemore, the bridge carries the A9 over a local road (Ch.2320). It was constructed circa 1982 and is a single span of corrugated metal pipe construction. The bridge crosses beneath the A9 at a skew of approximately 46°. The clear square span is 3.8m and the structure is 45m long. Tensioned corrugated steel safety barriers are provided in the verges and a timber pedestrian guardrail is provided around the headwalls.

Photograph 2.11.2 Ballinluig pedestrian underpass

Review against current standards

2.11.7. The cross section of this bridge does not meet the current standards required for a single carriageway. The verge widths of 1.6m and 1.9m do not satisfy the requirement of 2.5m for a carriageway over a buried structure. The hard strip width of 0.7m does not meet the requirement of 1.0m. Some widening would be required to meet the current cross section standard.

2.11.8. Records indicate that the structure has been designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Lynwilg Underpass (A9 1120)

Description

2.11.9. Located approximately 3km south west of Aviemore, the bridge carries the A9 over a local road (Ch. 3110). It was constructed circa 1982 and is a single span of corrugated metal pipe construction. The bridge is square with a span of 3.8m. The structure is 37.8m long and corrugated steel and wire rope safety barriers are provided in the verges and a timber pedestrian guardrail is provided around the headwalls.

Photograph 2.11.3 Lynwilg Underpass

Review against current standards

2.11.10. The cross section of this bridge does not meet the current standards required for a single carriageway. The hard strip width of 0.7m does not meet the requirement of 1.0m, but the overall width to back of verges is more than adequate. Modification of the kerb lines would be required to achieve the current cross section standard.

2.11.11. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

2.11.12. Potential utilities diversions required for construction, Scottish Water Main (SWM), Underground Low Voltage cable (UGLV) and Overhead High Voltage Cable (OHHV), exact location of utilities to be determined by service providers.

Allt na Criche (A9 1130)

Description

2.11.13. Located approximately 2.5km south west of Aviemore, the bridge carries the A9 over a watercourse (Ch. 3910). It was constructed circa 1980 and is a single span of reinforced concrete box construction. The bridge has a skew of approximately 10° and the skew span length is approximately 6m. The deck is 13.2m wide with raised verges 1.8m wide at each edge. Aluminium P2 parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.4 Allt na Criche

Review against current standards

2.11.14. The cross section of this bridge does not meet the current standards required for a single carriageway. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verge width of 1.8m does satisfy the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. Modification of the kerb lines would be required to achieve the current cross section standard.

2.11.15. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Craig Dhu Underpass (A9 1140)

Description

2.11.16. Located approximately 1.5km south west of Aviemore, the bridge carries the A9 over a local road (Ch. 5120). It was constructed circa 1980 and is a single span of corrugated metal pipe construction. The bridge is square with a span of approximately 3.7m. Corrugated steel tensioned safety barriers are provided in the verges and a timber pedestrian guardrail is provided around the headwalls.

2.11.17. A site visit by AMJV on 11 November 2015 noted flooding on the local road at the western entrance to the structure, recorded during the site visit as the result of a collapsed drain.

Photograph 2.11.5 Craig Dhu Underpass

Review against current standards

2.11.18. The cross section of this bridge does not meet the current standards required for a single carriageway. The combined carriageway and hard strip width of 8.8m does not meet the requirement of 9.3m, but the overall width to back of verges is more than adequate. Modification of the kerb lines would be required to achieve the current cross section standard.

2.11.19. Records indicate that the structure has been designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Craigellachie National Nature Reserve Underpass (A9 1150)

Description

2.11.20. Located immediately west of Aviemore, the bridge carries the A9 over a walking path leading to Loch Puladdern (Ch. 5680). It was constructed circa 1980 and is a single span of buried corrugated metal pipe construction. The bridge is square with a span of approximately 3.8m. The structure is 33.75m long and corrugated steel tensioned safety barriers are provided in the verges. A timber pedestrian guardrail surrounds the headwalls.

Photograph 2.11.6 Craigellachie Nature Reserve Underpass

Review against current standards

2.11.21. The cross section of this bridge does not meet the current standards required for a single carriageway. The combined carriageway and hard strip width of 8.8m does not meet the requirement of 9.3m, but the overall width to back of verges is more than adequate. Modification of the kerb lines would be required to achieve the current cross section standard.

2.11.22. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

2.11.23. Potential utilities diversions required for construction, Trunk Scottish Water Main (SWM), exact location of utilities to be determined by service providers.

Milton Caravan Site Underbridge (A9 1160)

Description

2.11.24. Located immediately west of Aviemore, the bridge carries the A9 over a walking path leading to Loch Puladdern (Ch. 7650). It was constructed circa 1980 and is a single span of corrugated metal pipe construction. The bridge is square with a span of approximately 3.8m. The structure is 33.75m long and corrugated steel tensioned safety barriers are provided in the verges, timber pedestrian guardrails provided around the headwalls.

Photograph 2.11.7 Milton Caravan Site

Review against current standards

2.11.25. The cross section of this bridge does not meet the current standards required for a single carriageway. The combined carriageway and hard strip width of 8.8m does not meet the requirement of 9.3m, but the overall width to back of verges is more than adequate. Modification of the kerb lines would be required to achieve the current cross section standard.

2.11.26. Records indicate that the structure has been designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

2.11.27. Potential utilities diversions required for construction, Scottish Water Main (SWM), Trunk Scottish Water Main (SWM) and Overhead BT Cable (OHBT), exact location of utilities to be determined by service providers.

High Burnside Underpass (A9 1162)

Description

2.11.28. Located immediately west of Aviemore, the bridge carries the A9 over a private road leading to a new housing development (Ch. 7760). It was constructed circa 2006 and is a single span of integral reinforced concrete construction. The end supports comprise full height reinforced concrete abutments on spread footings. The bridge has a skew of approximately 20° and the skew span length is approximately 9.6m. The deck is 13.8m wide with raised verges at each edge. Steel parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.8 High Burnside Underpass

Review against current standards

2.11.29. The available as-built drawing does not provide sufficient information to allow a review of the current cross section to be undertaken. However, the overall deck width, 12.8m, is adequate to satisfy current standards considering the parapets to act as the vehicle restraint system and a raised verge greater than 0.6m. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

2.11.30. Potential utilities diversions required for construction, Underground High Voltage cable (UGHV), exact location of utilities to be determined by service providers.

Granish Underpass (A9 1170)

Description

2.11.31. Located approximately 1km north of Aviemore, the bridge carries the A9 over a small farm track (Ch. 8720). It was constructed circa 1980 and is a single span of corrugated metal pipe construction. The bridge is square with a clear span of approximately 3.8m. The structure is 35.7m long and corrugated steel tensioned safety barriers are provided in the verges. Timber pedestrian guardrails surround the headwalls.

Photograph 2.11.9 Granish Underpass

Review against current standards

2.11.32. The cross section of this bridge does not meet the current standards required for a single carriageway. The west verge width of 2.3m does not satisfy the requirement of 2.5m and the combined carriageway and hard strip width of 8.8m does not meet the requirement of 9.3m. However, the overall width to back of verges is more than adequate, although modifications to the kerb lines and alignment would be required to achieve the current cross section standard.

2.11.33. Records indicate that the structure has been designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Carrbridge Underpass (A9 1180)

Description

2.11.34. Located approximately 8.7km north of Aviemore, the bridge carries the A9 over an unclassified local road (Ch. 16920). It was constructed circa 1979 and is a single span integral reinforced concrete structure. The end supports comprise full height reinforced concrete cantilever abutments on spread footings. The bridge has a shallow skew and the skew span length is approximately 8.1m. The deck is 13.44m wide with raised verges 2.1m wide (west) and 1.7m wide (east). Aluminium P2 parapets are mounted on plinth upstands at the rear of the verges. The headroom to the carriageway below is signed as 4.4m – 14' 6". It should be noted that the masonry arch railway bridge to the east on the same road has a lower signed headroom: 12' 3".

Photograph 2.11.10 Carrbridge Underpass from the west. Note the masonry arch railway bridge in the background.

Review against current standards

2.11.35. The cross section of this bridge does not meet the current standards required for a single carriageway. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verge widths of 1.7m and 2.1m do satisfy the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. Overall, the structure width is adequate, hence modification of the kerb lines would result in the necessary cross section standard being achieved.

2.11.36. Records indicate that the structure has been designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

2.11.37. The following utilities diversions are potentially required for construction: Scottish Water Main (SWM), Underground Low Voltage cable (UGLV), Underground BT Cable (UBT) and Overhead BT Cable (OHBT). The exact location of utilities to be determined by records obtained from service providers.

Dulnain Underbridge (A9 1190)

Description

2.11.38. Located approximately 8.7km north of Aviemore, the bridge carries the A9 over the River Dulnain (Ch. 16950). It was constructed circa 1979 and is a three span structure, with the superstructure comprising continuous weathering steel plate girders composite with a reinforced concrete slab deck. The intermediate supports comprise reinforced concrete 'T' profile columns on spread footings and the end supports comprise reinforced concrete bank seat abutments on spread footings (south) and piled foundations (north). The bridge is square and has spans of approximately 25m, 34.3m and 23m. The deck is 13.2m wide and has raised verges at each edge. Aluminium P2 parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.11 Dulnain Bridge

Review against current standards

2.11.39. The cross section of this bridge does not meet the current standards required for a single carriageway. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verges width of 1.8m satisfies the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. Overall, the structure width is adequate, hence modification of the kerb lines would result in the necessary cross section standard being achieved.

2.11.40. A load assessment carried out in 1996 identified that the structure had a capacity of 40 tonnes Assessment Live Load (ALL) and an HB capacity of 45 units. These results are in line with the original design loading for the structure.

2.11.41. Data from the Preliminary Engineering Services Report (PES) indicates that no utilities run across the structure. However according to as-built drawing 4069-701, eight 100mm service ducts have been provided in the verges.

Baddengorm Underbridge (A9 1200)

Description

2.11.42. Located approximately 9.6km north of Aviemore, the bridge carries the A9 over a watercourse (Ch. 17800). It was constructed circa 1979 and is a single span bridge with a reinforced concrete slab deck. The end supports comprise full height reinforced concrete abutments on spread footings. The bridge has a skew of 40° and the skew span length is approximately 13.7m. The deck is 13.2m wide with raised verges at each edge. Aluminium P2 parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.12 Baddengorm Bridge

Review against current standards

2.11.43. The cross section of this bridge does not meet the current standards required for a single carriageway. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verges width of 1.8m satisfies the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. Overall, the structure width is adequate, hence modification of the kerb lines would result in the necessary cross section standard being achieved.

2.11.44. The bridge is recorded as being designed to accommodate full HA loading and 45 units of HB loading. There is no record of an assessment of load carrying capacity to provide recent verification of its load carrying capacity.

Slochd Beag Bridge

Description

2.11.45. Located approximately 13.9km north of Aviemore, the bridge carries the A9 over a valley, the Perth to Inverness railway line and a local road (the old A9, U2400) (Ch. 22,100). It was constructed in 1979 and is a three span structure with the superstructure comprising continuous weathering steel plate girders composite with a reinforced concrete slab deck. The intermediate supports are reinforced concrete 'T' profile columns on piled foundations (south) or spread footings (north). The end supports are full height reinforced concrete cantilever abutments on spread footings. The bridge is square and has span lengths of 40m, 65m and 40m. The deck is 13.2m wide with raised verges at each edge. Aluminium and steel parapets are mounted on plinth upstands at the rear of the verges.

Photograph 2.11.13 Slochd Beag Bridge

Review against current standards

2.11.46. The cross section of this bridge does not meet the current standards required for a single carriageway. The vehicle restraint system over the structure is provided by P2 parapets, therefore the raised verges width of 1.8m satisfies the minimum requirement of 0.6m as stipulated in Cl. 5.7.4 of TD27/05. However, the combined carriageway and hard strip width of 8.7m does not meet the requirement of 9.3m. Overall, the structure width is adequate, hence modification of the kerb lines would result in the necessary cross section standard being achieved.

2.11.47. It should be noted that it is yet to be determined whether or not Network Rail require H4a parapets to be retrofitted to the structure. This will be resolved with Network Rail during Stage 3, in accordance with DMRB standard TD19/06 Requirement for Road Restraint Systems.

2.11.48. A load assessment carried out in 1995 identified that the structure had a capacity of 40 tonnes Assessment Live Load (ALL) and an HB capacity of 45 units. These results are in line with the original design loading for the structure.

2.11.49. A utilities search did not indicate any utilities across the structure (refer to Volume 2, Figure 2.4). As-built drawing 4069-917 indicates eight 100mm service ducts have been provided in the verges, currently believed to be unused.

Culverts

2.11.50. The 29 No. culverts located between Dalraddy and Slochd are as shown in Table 2.11.2. Principal Inspection reports are available for some of the structures, and this information was supplemented by AtkinsMouchel Joint Venture site inspections.

Table 2.11.2: Culverts between Dalraddy and Slochd

Culvert Name	Principal Inspection Report Available	Form of Construction
A9 1100 C70 Caochan Burn	Yes	Buried corrugated metal pipe
A9 1110 C10 Ballinluig Burn	Yes	Buried corrugated metal pipe
A9 1120 C19 Lynwilg Farm	No	Buried corrugated metal pipe
A9 1130 C54 Kinakyle	No	Buried corrugated metal pipe
A9 1150 C7	No	Unknown
A9 1150 C49	No	Buried corrugated metal pipe
A9 1150 C25	No	Buried corrugated metal pipe
A9 1150 C11	No	Buried corrugated metal pipe
A9 1150 C95 Steallan Dubh	Yes	Buried corrugated metal pipe
A9 1170 C4 Granish	No	Buried corrugated metal pipe
A9 1170 C6 Shunem	No	HDPE Pipe
A9 1170 C12 Allt Na Criche	Yes	Buried corrugated metal pipe
A9 1170 C18 Avielochan 1	No	Buried corrugated metal pipe
A9 1170 C20 Avielochan 2	No	Buried corrugated metal pipe
A9 1170 C22 Avielochan 3	Yes	Buried corrugated metal pipe
A9 1170 C23 Avielochan 4	No	Buried corrugated metal pipe
A9 1170 C26 Avielochan 5	No	Buried corrugated metal pipe
A9 1170 C53 Kinveachy Kennels	No	Buried corrugated metal pipe
A9 1170 C75 Fèith Mhòr	Yes	Buried corrugated metal pipe
A9 1170 C77 Crannaich 1	Yes	Buried corrugated metal pipe
A9 1170 C81 Crannaich 2	No	Buried corrugated metal pipe
A9 1206 F Slochd Summit 2 F/B*	No	Masonry arch
A9 1207 F Slochd Summit 3 F/B*	No	Masonry arch
A9 1208 F Slochd Summit 4 F/B*	No	Masonry arch
A9 1209 F Slochd Summit 5 F/B*	No	Masonry arch
A9 1210 C31 Slochd Mhuic	No	Integral reinforced concrete box
A9 1210 C39 Slochd Mòr 1	No	Integral reinforced concrete box
A9 1210 C45 Slochd Mòr 2	Yes	Buried corrugated metal pipe
A9 1210 C46 Slochd Mòr 3	Yes	Buried corrugated metal pipe

*Structures denoted “Slochd Summit F/B” are not footbridges, but culverts underneath the non-motorised user route NCN7, which runs parallel to the A9 in the vicinity of Slochd Summit.

2.11.51. All 29 No. culverts are single span structures. 9 No. are corrugated steel pipe construction while the other 16 No. are of unknown construction. The culverts were constructed over various periods during 1976, 1980 or 1982 and have spans ranging from 0.9m to 2.3m. 25 No. culverts carry the A9 mainline over small watercourses or carry catchment runoffs under the A9 trunk road. The 4 other culverts, marked with an asterisk in the table above, carry culverted streams underneath a footpath in the Slochd Summit area, and are sometimes recorded as footbridges for this reason. Principal Inspection reports were available for several of the culverts and the key findings from this information are summarised below:

2.11.52. A9 1100 C70 Caochan Burn – Principal Inspection (PI) noted that the structure was in a good condition with the exception of minor defects such as loss of bitumen coating in isolated areas. Poor workmanship is evident in sections of the lower section in the form of poor coating of the culvert liner. Early settlement was noted to have occurred. Cracks and moss/lichen growth was observed on the head walls.

2.11.53. A9 1110 C10 Ballinluig Burn – PI from 2012 noted that the structure was in a good condition at time of the inspection. Incomplete pedestrian protection was observed which should be extended to cover the uplink side of the culvert.

2.11.54. A9 1150 C95 Steallan Dubh – PI from 2009 noted that the structure was in good condition with the exception of minor defects such as a minor loss of the protective coating and surface rusting to the steel pipe along the water line. Cracking/loosening of the pointing on the batter paving around both portals was observed.

2.11.55. A9 1170 C12 Allt Na Criche – PI from 2011 noted that the structure was in a good condition with the exception of minor defects such as a minor loss of bituminous coating on culvert walls and abutments. Minor spalling and cracking of the head and wing walls was observed. No pedestrian fencing is present on the wing walls.

2.11.56. A9 1170 C22 Avielochan 3 – PI from 2009 noted that the structure itself was in good condition at the time of the inspection with only minor loss of the protective coating and corrosion to the steel pipe invert noted. No vehicle restraint (safety barrier) or pedestrian fencing is present above either portal. It was noted that there was a need to have the upstream training works/cascade rebuilt as they had totally collapsed into the stream due to scour/erosion action. The loss of the training works had led to the friable upstream river banks being undermined resulting in earth slippage into the watercourse close to the culverts inlet, including a very large boulder (approx. 2m3) which has come to rest within a few metres of the inlet portal. Further movement of this boulder or subsequent accumulation of debris will certainly affect the culverts ability to carry water at times of spate. It was noted that the boulder and other debris should be removed, the training works rebuilt and the embankments stabilised. The 2015 PI reports that these works are yet to be undertaken.

2.11.57. A9 1170 C75 Fèith Mhòr – PI from 2011 noted that the structure was in a good condition with the exception of minor defects consistent with the age of the structure. A loss of the protective coating on the steel pipe along the water line was observed. It was noted that deformation/dipping of the pipe at the crown approximately at the midpoint of the pipe, which possibly dates from the time of construction. Minor vertical shrinkage cracks were observed on the headwalls.

2.11.58. A9 1170 C77 Crannaich 1 – PI of 2011 noted that the structure was in a good condition with the exception of minor defects consistent with the age of the structure. Loss of the protective coating and surface rusting to the steel pipe along the water line was noted. It was noted that deformation/dipping of the pipe at the crown approximately at the midpoint of the pipe, which possibly dates from the time of construction. A series of shallow spalls along the top edge and widespread across the face of the right hand headwall was observed. Parallel cracking to the pipe circumference indicates possible early signs of future spalling. Minor shrinkage cracking was observed on the left hand headwall.

2.11.59. A9 1210 C45 Slochd Mòr 2 – PI of 2009 noted that the structure was in a good condition with the exception of minor defects such as loss of mastic bitumastic coating on the exposed ends of the pipe. It was noted that the watercourse just upstream of the culvert on the RHS appears to be moving laterally where it encounters a sharp bend, eroding the out bank. It is likely that in time the stream will need to be re-engineered to return it to its intended route.

2.11.60. A9 1210 C46 Slochd Mòr 3 - PI of 2009 noted that the structure was in a good condition with the exception of minor defects such as light corrosion due to loss of protective coating, silting, insignificant cracking of the concrete headwalls and loss of point to a training wall. It was also noted that there was no vehicle or pedestrian restraint fencing above the left hand side headwall.

Minor Structures

2.11.61. The 3 No. livestock creeps located between Dalraddy and Slochd are as follows:

- A9 1100 C69 Loch Alvie Creep
- A9 1150 C87 Milton Sheep Creep
- A9 1170 C32 Laggantygowan Creep

The livestock creeps are all of corrugated buried steel pipe construction and are listed below. The mammal underpasses have spans of either 1.9m or 2m.

2.11.62. A9 1100 C69 Loch Alvie Creep – it should be noted that from the 2012 PI that the structure is in good condition.

2.11.63. A9 1150 C87 Milton Sheep Creep – the 2009 PI confirmed that the structure was in a good condition with the exception of minor defects such as surface rust on the rivets which secure the plated joints, and cracking/loosening of the mortar pointing and minor localised loss of masonry from the batter paving around the portals.

2.11.64. A9 1170 C32 Laggantygowan Creep – the 2011 PI confirmed that the structure was in a good condition, with the exception of minor defects such as surface rusting and insignificant localised dents and deformations of the steel. Minor cracking was observed on the headwall. Transverse cracks were noted in the road surface, believed to stem from long term settlement of the fill above the livestock creep.

2.11.65. There are also 2 No. VMS signs on the route. They are large variable message signs offset to one side of the carriageway supported on single columns. One was constructed circa 2007 and the other circa 1997. Both signs are recorded as being in good condition.

2.12. Lay-bys

2.12.1. There are 19No. lay-bys located within the project extents, consisting of 2No. Type A lay-bys and 17No. Type B lay-bys, see Table 2.12.1.

Table 2.12.1: Lay-by Locations.

Lay-by Number	Direction	Type	Chainage (m)	Description
129	N/B	B	650	
130	S/B	B	2,550	
131	S/B	B	5,100	
132	N/B	B	5,800	Informal pedestrian access available to Craigellachie Nature Reserve from back of lay-by.
133	S/B	B	6,700	
134	N/B	B	6,900	
135	S/B	B	9,550	
136	N/B	B	9,750	
137	S/B	B	11,350	
138	N/B	B	11,950	
139	N/B	B	13,100	
140	S/B	B	13,400	
141	S/B	B		Lay-bys 141 to 144 identified previously within the PES Report, Appendix L are noted to no longer exist. The construction of the Carrbridge WS2+1 scheme resulted in the removal of these lay-bys.
142	N/B	B		
143	S/B	B		
144	N/B	A		
145	N/B	B	17,200	
146	S/B	B	18,150	
147	S/B	B	20,000	
148	N/B	B	20,150	
149	S/B	A	20,600	
150	N/B	B	22,650	
151	S/B	A	23,400	

2.13. Average Speed Cameras

2.13.1. In 2014 average speed cameras were installed on all sections of single carriageway of the A9 between Perth and Inverness. Within this section there are five average speed camera sites, located at:

- south of Aviemore South Junction
- south of Granish Junction
- south of Carrbridge at the southern end of the WS2+1
- north of Black Mount Junction
- Slochd Summit near the northern extent of this scheme.

2.14. Traffic Flows

2.14.1. The traffic volume for this section of the A9 has been obtained from the 2012 Automatic Traffic Count (ATC) data provided by Transport Scotland. The two way traffic volume, obtained was 7,600 AADT.

2.14.2. Traffic flows are noted to vary along the length of the route. Typically flows are slightly higher to the northern and southern ends of the project and lower in the middle. This is considered to be attributable to the limited access to the north and south, whereby traffic approaching from the south disperses at Aviemore South junction and traffic approaching from the north disperses at Black Mount junction. However, overall this variation is not considered significant given that all flows are well within the capacity of the route.

2.14.3. It is also noted that there is considerable seasonal variation experienced, with peak summer flows in the order of 30% higher on summer weekdays compared to winter weekdays and summer weekend flows can be double those in winter. The proportion of traffic turning on and off the A9 also varies seasonally with much greater turning flows recorded in the summer. There is much less variation by day of the week with flows being relatively constant across the week.

2.14.4. Details of the surveyed traffic flows recorded along the length of the project including turning movements at the junctions is fully detailed within Part 4 – Traffic and Economic Assessment, Figure 20.2.

2.15. Existing Geometry

2.15.1. The existing geometry of the A9 carriageway was assessed and reported within the PES, with details relevant to the Dalraddy to Slochd project extents included within Appendix F of the report.

2.15.2. In summary, there was a total of 7No. identified departures over the scheme extents, all of which related to combined relaxations between stopping sight distance and vertical or horizontal geometry.

2.15.3. AMJV have subsequently conducted a separate review of the existing A9 mainline geometry and junctions and note the results of this assessment within Table 2.15.1.

Table 2.15.1: Existing A9 Geometry Assessment

Chainage	Type	DMRB Reference	Required Standard	Standard Provided	Departure/ Relaxation
0 – 700	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1250m	Relaxation
788 – 1105	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1590m	Relaxation
1179 – 1995	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1750m	Relaxation
2366 – 2987	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1555m	Relaxation
3823 – 4393	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=750m	One Step Below
9490 – 10341	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1495m	Relaxation
10486 – 11011	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=980m	One Step Below
17511– 18288	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1230m	Relaxation
18313– 19599	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=2186m	Relaxation
21646– 21902	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=510m	Two steps below
21994 – 22738	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=2335m	Relaxation
22985 – 23521	Horizontal Curvature	Volume 6, Section 1, Part 1, TD9/93 Table 3	Minimum Horizontal Curvature=2040	R=1720m	Relaxation
2200 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.8	'X' Distance = 9m	'X' Distance = 4.5m	Relaxation
2200 SB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.8	'X' Distance = 9m	'X' Distance = 4.5m	Relaxation

Chainage	Type	DMRB Reference	Required Standard	Standard Provided	Departure/ Relaxation
3175 SB B9152 Junction	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.8	'X' Distance = 9m	'X' Distance = 4.5m	Relaxation
3270 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	'Y' Distance = 160m 'X' Distance = 4.5m	Departure
4650 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 160m 'X' Distance = 4.5m SB 'Y' Distance = 295m 'X' Distance = 4.5m	Departure
12400 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	'Y' Distance = 160m 'X' Distance = 4.5m	Departure
12400 SB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.8	'X' Distance = 9m	'X' Distance = 4.5m	Relaxation
13250 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 160m 'X' Distance = 2.4m SB 'Y' Distance = 160m 'X' Distance = 2.4m	Departure
13250 SB (Access to B9153)	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 160m 'X' Distance = 2.4m SB 'Y' Distance = 160m 'X' Distance = 2.4m	Departure
17050 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 295m 'X' Distance = 4.5m	Relaxation

Chainage	Type	DMRB Reference	Required Standard	Standard Provided	Departure/ Relaxation
				SB 'Y' Distance = 295m 'X' Distance = 4.5m	
17050 SB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 295m 'X' Distance = 4.5m SB 'Y' Distance = 295m 'X' Distance = 4.5m	Departure
22800 (Slochd Junction)	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.8	'X' Distance = 9m	NB 'X' Distance = 4.5m	Relaxation
24250 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	SB 'Y' Distance = 215m 'X' Distance = 4.5m	Departure
24250 SB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 215m 'X' Distance = 4.5m SB 'Y' Distance = 160m 'X' Distance = 4.5m	Departure
25250 NB	Junction Visibility	Volume 6, Section 2, Part 6, TD42/95, Clause 7.6c and 7.8	'Y' Distance = 295m 'X' Distance = 9m	NB 'Y' Distance = 215m 'X' Distance = 4.5m SB 'Y' Distance = 215m 'X' Distance = 4.5m	Departure

2.15.4. As detailed in Table 2.15.1, in terms of the existing A9 geometry it can been seen that there is a series of relaxations identified related to horizontal geometry. For the departures which have been identified, these all relate to substandard visibility at junctions and accesses with no issues identified with regards to visibility requirements on the mainline geometry.

2.15.5. Through the promotion of the dualling project and construction of dedicated north and southbound carriageways, all of the existing relaxations and departures identified will be removed.

2.16. Road Pavement

2.16.1. Details on the existing road pavement have been determined through a review of Transport Scotland's Integrated Roads Information System (IRIS) database. This provides details of pavement material, thickness, structural properties as well as a prediction on the residual pavement life.

2.16.2. The original A9 carriageway was constructed largely as a flexible composite pavement. However over time as improvement and maintenance works have been implemented, there has been a change to fully flexible construction. An example of this is the WS2+1 scheme promoted adjacent to Carrbridge.

2.16.3. Based on the data within the IRIS database, as reported within the PES Report of March 2014, the residual pavement life predicted for sections of the Dalraddy to Slochd project is summarised within Table 2.16.1. It is noted that the details available do no cover the full project extents.

Table 2.16.1: Residual Pavement Life

Section Location	Carriageway Direction	Carriageway Construction	Series Residual Life (Years)
Dalraddy to Carrbridge	North-Bound	Flexible composite (mainly), fully flexible (partially)	10 to 20
Carrbridge to Slochd	South-Bound	Flexible composite (mainly), fully flexible (partially)	5 to 10

2.17. Road Lighting

2.17.1. There is no road lighting provision on the A9 mainline carriageway or at any of the existing at grade junctions on section of the A9 between Dalraddy and Slochd.

2.17.2. The side road network located adjacent to the A9 has road lighting in place on approach and within residential areas. This is particularly evident on the B9152 at Aviemore and the A938 and B9153 at Carrbridge. Outwith these areas there is generally no road lighting provision in place.

2.17.3. Feature lighting in the form of floodlights are installed on the rock cutting adjacent to the A9 northbound carriageway at Kinakyle, located south of Aviemore. The lighting at this location serves the purpose of illuminating the rock face to create a landmark feature in the vicinity of Aviemore.

2.18. Road Restraint Systems

2.18.1. Road restraint systems are installed along lengths of the A9 mainline and at various sites such as existing at grade junctions to protect against hazards such as large cuttings, road furniture, and structures.

2.18.2. The systems in use encompass a variety of different specifications including; wire rope, tension corrugated beams and open box beams.

2.18.3. Details of the restraint systems promoted at the existing structures are detailed separately as noted in section 2.11.

2.19. Signage

2.19.1. Existing signage is provided along the length of the scheme serving a number of different purposes for trunk road users. The types of signs encountered along the length of the section and within the extents of the existing at-grade junctions include:

- Regulatory Signs;
- Warning Signs;
- Advanced Direction Signs;
- Direction Signs
- Route Confirmatory Signs;
- Tourist Direction Signs;
- Miscellaneous Information Signs; and
- Variable Message Signs

2.19.2. On sections of the route which have undergone improvement works, such as the WS2+1 at Carrbridge, signs are generally found to be in a good condition and are clearly legible. Other, older signs have evidence of being dirty or damaged, which results in the message being less clear to road users. In the southern section of the project, particularly between Dalraddy and Carrbridge, there is dense tree plantations where there is potential for signs being partially obscured from vegetation.

2.19.3. As a consequence of the A9 forming a key route to the highlands, it is utilised by a high volume of tourist traffic throughout the year. Tourist signs therefore form an important function to provide direction to tourist destinations. Tourist signs are evident on approach to the existing at grade junctions of Aviemore South, Granish and Black Mount to direct road users to the attractions within the immediate vicinity of Aviemore and Carrbridge and also beyond into the Cairngorms National Park.

2.20. Public Utilities

2.20.1. Public Utilities companies and Statutory Undertakers have been contacted and have supplied details of their plant information. Figure 2.4 in Volume 2 of this report illustrates the approximate location of these services and a brief description of key services is provided below.

Telecoms

2.20.2. British Telecom (BT) underground cables (including fibre optic cables) are located adjacent to the A9 carriageway at discreet locations with localised carriageway crossings also in place. In general BT apparatus is located within the adjacent side road network.

Electricity

2.20.3. Scottish and Southern Energy high voltage overhead electricity cables cross the A9 south of Carrbridge at Chainage Ch.13600.

Water

2.20.4. There is a trunk water main located in the southbound verge in the vicinity of Aviemore. South of Aviemore it is located within the verge of the B9152. It then continues northwards in the southbound verge.

Gas

2.20.5. There are no Gas mains located within the study area of the scheme. A privately owned LPG installation is located within the grounds of the MacDonald Highland Resort, Aviemore and adjacent to the existing A9.

Private Water Mains

2.20.6. There are a number of private water mains that cross and are in close vicinity to the A9 along the length of the project extents. The exact location of these will be fully determined and investigated further as part of the Stage 3 assessment. Consultation with landowners is ongoing with respect to this.

2.21. Non-Motorised Users

Footpaths

2.21.1. The Cairngorms National Park Core Paths Plan, see Volume 3, Figure 17.3, identifies core paths adjacent to the A9 corridor in the vicinity of Aviemore. To the west, are the core paths within Craigellachie Nature Reserve, and to the east is the Aviemore Orbital Path. There are nine core paths within the study area, eight designated by the Cairngorms National Park Authority, and one by The Highland Council along with nineteen other local or informal paths either on or off the road network. There are also six Rights of Way within the study area. Refer to Part 3, Chapter 17 – Effects on all travellers for full details of all NMU routes.

2.21.2. National Cycle Route 7 is also designated as a core path, which splits in Carrbridge. The western (off-road) branch follows the route of General Wade's Military road and passes beneath the A9 at Carrbridge Underpass. The eastern (on-road) branch follows the A938 to Black Mount junction and utilises the Slochd settlement access road crossing under the A9 at Slochd Beag Bridge. The two branches rejoin to the west of the A9 and then run parallel to the A9 towards and through Slochd Summit.

Cycle paths

2.21.3. The National Cycle Network Route 7, which runs from Sunderland to Inverness, passes through the scheme. Refer to the section above for details.

Crossing points

2.21.4. There are no formal at-grade NMU crossing points within this section, however the access between MacDonald Highland Resort and Craigellachie Nature Reserve is often utilised by NMUs seeking to access the Nature Reserve, instead of using the Craigellachie underpass.

Tracks

2.21.5. Details of tracks adjoining and running adjacent to the A9 carriageway are considered within Part 3, Chapter 17, Effects on All Travellers.

2.22. Bus Services

2.22.1. The long distance bus services that use the A9 are the G10 (from Inverness to Glasgow five times in each direction per day), M90 and the M91 (from Inverness to Edinburgh ten times in each direction per day). The G10 service is run by a combination of Stagecoach and Scottish Citylink under either the Megabus Gold or Citylink Gold brands. The M90 and M91 services are run by a combination of Stagecoach and Scottish Citylink under the Megabus brand. There are no bus lay-bys within this section; buses set down and pick up passengers within the settlements themselves, which the existing A9 alignment by-passes.

2.22.2. The local bus services that serve Carrbridge are the 32, 34, 34X and 35. The 32 runs between Newtonmore and Carrbridge four times a day in each direction on weekdays and three times a day in each direction on Saturdays. The 34 runs between Aviemore and Grantown on Spey, extending to and from Carrbridge for one service every evening. The 34X runs between Aviemore and Inverness running four times a day in each direction on weekdays and three times a day in each direction on Saturdays. The 35 runs between Newtonmore and Inverness twice daily on weekdays and once daily on Saturdays. All bus services to and from Carrbridge are operated by Stagecoach Highland.

2.22.3. The 34X uses the A9 between Tomatin and Carrbridge. All other services use local roads and not the A9.

2.23. Accidents

2.23.1. Accident data recorded on the A9 between Dalraddy and Slochd and the adjacent side road network over the period of 2008 to 2014 is summarised in Tables 2.23.1 and Table 2.23.2, with location details presented within Figure 2.5.

2.23.2. On the A9, it is noted that over this period that there was a total of 23No. slight accidents, 5No. serious and 3No. fatal. For the accident categories of slight and serious these are shown to be generally equally split between occurring at junctions and on the mainline. By comparison, all fatal accidents recorded are noted to have occurred away from the proximity of a junction location.

Table 2.23.1: A9 Dalraddy to Slochd Accident Data

Year	Accident Severity					
	Slight		Serious		Fatal	
	Not At Junction	Within 20m of Junction	Not At Junction	Within 20m of Junction	Not At Junction	Within 20m of Junction
2008	4	1	0	1	1	0
2009	1	3	0	0	0	0
2010	2	2	0	2	0	0
2011	3	0	0	0	1	0
2012	3	1	2	0	0	0
2013	0	2	0	0	1	0
2014	0	1	0	0	0	0
TOTAL	**13**	**10**	**2**	**3**	**3**	**0**

2.23.3. Accident records for local roads adjacent to the Dalraddy to Slochd project, which includes side roads and junction link roads over the period of 2008 to 2014 shows an overall low occurrence of accidents. In particular it is noted that there have been no accidents defined as serious or fatal recorded within the period. From the accident records, a total of 6No. were categorised as slight, with the majority of which defined as occurring not at a junction location.

Table 2.23.2: Dalraddy to Slochd Side Road & Link Road Accident Data

Year	Accident Severity					
	Slight		Serious		Fatal	
	Not At Junction	Within 20m of Junction	Not At Junction	Within 20m of Junction	Not At Junction	Within 20m of Junction
2008	1	0	0	0	0	0
2009	1	0	0	0	0	0
2010	0	1	0	0	0	0
2011	1	1	0	0	0	0
2012	0	0	0	0	0	0
2013	1	0	0	0	0	0
2014	0	0	0	0	0	0
TOTAL	**4**	**2**	**0**	**0**	**0**	**0**

2.23.4. In comparison to accident trends across the A9 network and national trends [Ref 2-2] it can been seen that it is generally consistent with an overall decrease in accidents occurring over the recording period. In addition, it is also noted that for all the fatal accidents that have been recorded, they are located outwith the extents of a junction. This follows the A9 trend where fatal accidents are primarily the consequence of overtaking as opposed to junction turning manoeuvres.

2.23.5. As noted in section 2.13.1 average speed cameras were installed on the A9 corridor between Dunblane and Inverness in 2014. The primarily purpose of these are to influence driver behaviour and target a reduction in excess speeding. Reports on the performance of the system have indicated that it has been effective in promoting speed enforcement and also offered associated benefits in accident reductions.

2.24. References

2-1 Met Office (2015) UK Northern Scotland: climate. Available at: http://www.metoffice.gov.uk/climate/uk/ns/. (Accessed 4 December 2015).

2-2 Transport Scotland (2013) Reported Road Casualties Scotland 2013. Available at: http://www.transport.gov.scot/statistics. (Accessed 3 November 2016).

3. Description of Route Options

3.1 Option Development

Methodology

3.1.1. During the initial stages of option development, a number of different options and combinations of mainline, junction locations and junction layouts were identified. Individual sifting exercises were undertaken for both the mainline widening options and the junctions in order to identify viable options to be taken forward to the Stage 2 assessment Process.

3.1.2. The approach adopted for the sifting exercises is outlined within the following sections of this report, with detailed descriptions, methodology and assessment matrices included within the project reports noted below:

- AP11-AMJ-HGN-Z_JC000_XX-RP-RD-0002: Approach to Mainline Options Sifting (August 2015)
- AP11-AMJ-HGN-Z_JC000_XX-RP-RD-0001: A9 Dualling Dalraddy Slochd Approach to Junction Options Sifting (April 2016)

3.1.3. The development of the Proposed Scheme Options included consideration of the environmental constraints present within the A9 Corridor and has sought to mitigate, where possible, the potential for adverse impacts. Such mitigation has been embedded into the design of the Proposed Scheme Options wherever possible. The following considerations have therefore been included in the sifting of the mainline options and have defined the 54No. mainline and junction option combinations being taken forward in this DMRB Stage 2 assessment:

- Minimising potential impact on people and communities by avoiding direct encroachment onto property, optimising land take and facilitating access requirements;
- Horizontal and vertical alignments designed to be as close to the existing A9 as possible to minimise earthwork embankments and land take;
- Minimising encroachment into areas of ancient woodland;
- Preliminary consideration of earthwork slopes. The approach that has been undertaken to provide consistency in order to differentiate between the proposed route options. Opportunities for potential for variation of slope gradients to achieve best landscape fit and to reduce impact on Ancient Woodland Inventory exist and have been identified through preliminary studies. These will be explored further as part of DMRB Stage 3;
- Minimising encroachment into areas at risk of flooding;

- Surface water runoff arising from the proposed A9 dual carriageway will be subjected to a minimum of two levels of treatment. Surface water runoff arising from side roads will be subject to a minimum of one level of treatment in accordance with SEPA's regulatory guidance WAT-RM-08 [Ref 3-2]. Attenuation Sustainable Urban Drainage Systems (SUDS) will be positioned outwith the mapping extents of SEPA's medium flood risk zones for a 1:200 year return period, the extents of these zones will be subject to further verification in DMRB Stage 3, and contributions to compensatory flood plain storage will be considered where required;

- Avoidance of known areas of deeper peat; and

- Alignments designed to facilitate access through the A9 corridor for Non-Motorised Users with specific consideration to the National Cycle Network, Rights of Way and Core Paths.

Mainline

3.1.4. A sifting workshop for the mainline was held on 17th August 2015. The workshop evaluated the 3No. mainline widening options for the upgrade of the existing A9 to dual carriageway between Dalraddy and Slochd. The conclusions of the sifting exercise and methodology identified for progressing the options through the DMRB Stage 2 assessment were recorded in the report A9P11-AMJ-HGN-Z_ML000_XX-RP-RD-001: A9 Dualling Dalraddy Slochd Mainline Sifting and are outlined in the following sections of this report.

3.1.5. The 3No. mainline options which were considered for widening are listed below and illustrated in Figure 3.1 of Volume 2 of this report. It is noted that all the widening options were based within a 200m wide corridor of the existing A9 carriageway as identified from earlier option assessment and evaluation work undertaken during the PES :

- widening to the northbound side of existing;

- widening to the southbound side of existing; and

- symmetrical widening – widening to each side of the existing.

3.1.6. Prior to the sifting workshop, the route was split into sections. This was intended to allow for a logistical breakdown and subsequent assessment of the constraints along the route. The proposed sections were chosen to allow the potential impacts to be considered and managed within a single section so far as possible. The sections start and end points were not considered as fixed points, but as flexible boundaries which were discussed and amended as necessary during the workshop. A total of 13No. individual sections were identified along the route length and these have been used going forward for the purposes of the initial option sifting and also form the structure of this Stage 2 assessment.

3.1.7. Following the identification of the sections, each of the mainline widening options were assessed to identify the potential impacts on identified constraints along the length of the route. A spreadsheet sifting tool was used to record the assessment for each widening option and this was presented and reviewed as part of the sifting workshop.

3.1.8. In addition to the known constraints, the overall constructability of the A9 was considered due to sensitivity of the A9 trunk road as a strategic route between the central belt and Highlands of Scotland. Extended closures or lengthy diversions have the potential to result in significant delays and disruption to road users. The symmetrical widening option presents the most significant challenge in maintaining two–way traffic during construction, as the new dual carriageway would straddle the existing. Furthermore, there are significant issues at structures, particularly for the major underbridge crossing at Dulnain River and Slochd Beag Bridge, where the structural form of the substructure does not lend itself to symmetrical widening. Symmetrical widening also presents difficulties in separating the workforce and construction vehicles from A9 users, resulting in a greater potential for health and safety related accidents arising, limiting working areas and potentially introducing longer construction periods.

3.1.9. The northbound and southbound widening options were identified to provide the advantage of allowing construction of one of the new carriageways offline from the existing, thereby allowing traffic to continue on the existing A9. Once a section of new carriageway has been constructed, traffic could then be transferred to the new carriageway to allow construction of the adjacent carriageway to proceed.

3.1.10. With regards to constructability, in particular the increased risk of accidents and delay to the travelling public, symmetrical widening was not considered to offer any advantage over either northbound or southbound widening. However, it was acknowledged that where significant constraints exist, there may be a need to introduce short discrete sections of carriageway which could be considered to be symmetrical, these localised adjustments shall be considered in order to minimise existing impacts.

3.1.11. The sifting process concluded that there would be 3No. mainline options to be progressed and considered as part of the Stage 2 assessment. This consisted of the following:

- Option 1 : based on predominantly southbound widening;
- Option 1a: based on predominantly southbound widening as Option 1 with a short section of symmetrical / northbound widening in the vicinity of Aviemore (sections 2, 3a and 3b); and
- Option 2 which was predominantly northbound widening.

3.1.12. Table 3.1.1 shows the different mainline options and these are described in detail within Section 3.2 to 3.13 of this report.

Table 3.1.1: Mainline Sifting Summary Table.

Section			Mainline Option 1		Mainline Option 1A		Mainline Option 2		Notes
			Predominately		Predominately		Predominately		
	Start Ch	End Ch	N - Bound	S - Bound	N - Bound	S - Bound	N - Bound	S - Bound	
1	0	2,500	-	✓		✓	✓	-	
2	2,500	3,500	-	✓	-	✓	-	✓	
3a	3,500	5,500	-	✓	Hybrid to avoid all properties		✓	-	
3b	5,500	6,700	-	✓	-	✓	✓	-	
4	6,700	7,900	-	✓		✓	✓	-	
5	7,900	10,400	-	✓		✓	✓	-	
6a	10,400	11,700	-	✓		✓	-	✓	
6b	11,700	13,000	-	✓		✓	✓		
7	13,000	16,300	-	✓		✓	✓	-	
8	16,300	17,600	-	✓		✓	✓	-	
9	17,600	20,900	-	✓		✓	✓	-	
10	20,900	23,100	-	✓		✓	-	✓	Localised adjustments to minimise rock cuts
11	23,100	25,030	-	✓		✓	-	✓	Localised adjustments to minimise rock cuts

*Section 11 has been shortened from Ch25780 to Ch25030 post sifting to provide a more representative point for the tie-in to the existing dual carriageway at the northern extents

3.1.13. While the 25km scheme has been broken down into 13 sections for the purposes of conducting the mainline alignment sifting exercise, the options to be assessed at Stage 2 comprise the alignments in their entirety, rather than component options for each of the 13 sections.

3.1.14. Moreover, in considering component options relating to each of the sections, potential combinations are too numerous to meaningfully and intelligibly relate these back to specific mainline alignment options and ultimately a preferred scheme.

3.1.15. Consequently, assessment of full mainline alignment options is considered a more workable approach in terms of reducing unnecessary complexity in the identification of impacts, affording enhanced clarity in the comparison of options, avoiding repetition in the reporting and in ensuring a holistic approach to assessment. For continuity and to assist with the ongoing design development and identification of a preferred option, key aspects/impacts will be referenced on the basis of the 13 section framework developed for sifting.

3.1.16. The approach proposed ensures that the focus of the assessment was firmly upon key aspects and impacts across the length of the scheme, rather than the more narrowed perspective afforded by the section constructs. The Stage 2 assessment will report the key impacts in relation to each of the mainline alignment options and junction options and a comparative appraisal will also be incorporated to highlight variations between the options under consideration.

3.1.17. Notwithstanding the above, in the identification of the preferred option, consideration will be given to utilising subsections from the different mainline alignment options and or promoting localised variations to the mainline where constraints and impacts are considered to merit a variation to the mainline geometry.

Mainline Options

3.1.18. Mainline Option 1 consists of fully southbound widening highlighted in green in table 3.1.1 with localised adjustments at the northern end of the scheme to minimise rock cuts in area of Slochd summit. Drawings illustrating this layout are presented in Figure 4.1 in Volume 2 of this report.

3.1.19. The following junction options are associated with Mainline Option 1:

- Aviemore South Junction Options A02, A09 and A18
- Granish Junction Options C31 and C34
- Black Mount Junction Options D03, D12 and D51

3.1.20. Mainline Option 1a is similar to Option 1 with the exception of a hybrid section between chainages 2500 to 6700 (Sections 2, 3a & 3b) to avoid all properties in this area. Drawings illustrating this layout are presented in Figure 4.2 Volume 2 of this report.

3.1.21. The junctions associated with Mainline Option 1 are noted to equally apply to Mainline Option 1a due to the similarity with alignment over the majority of the route length.

3.1.22. Mainline Option 2 consists of northbound widening with four deviations to southbound through the following chainages; 2,500 to 3,500 (section 2), 10,400 to 11,700 (section 6a), 20,900 to 25,030 (sections 10 &11), highlighted in purple in table 3.1.1. As with Option 1, there will be localised adjustments at the northern end of the scheme to minimise rock cuts in area of Slochd summit. Drawings illustrating this layout are presented in Figure 4.3 in Volume 2 of this report.

3.1.23. The following junction options are associated with Mainline Option 2:

- Aviemore South Options A02, A09 and A18
- Granish Options C18 and C21
- Black Mount Options D02, D07 and D13

3.1.24. It is noted that laybys have not been included in the Stage 2 mainline designs and therefore impacts associated with these will not be assessed as part of this Stage 2 assessment.

Junction Options

Junction Locations

3.1.25. A sifting workshop specifically relating to junctions was held with Transport Scotland on the 1st April 2016. During the workshop the approach and findings from earlier sifting exercises undertaken by the AMJV were presented. The junction sifting methodology was based on a phased approach where initially a review was focussed on junction locations. Thereafter a sifting exercise was conducted on the junction layouts to determine which layouts should be taken forward to Stage 2 assessment.

3.1.26. The conclusions of the sifting exercises undertaken in respect to junction location and layout and the recommendations for taking forward are recorded in the report A9P11-AMJ-HGN-Z_JCZZZ_ZZ-RP-CI-001: A9 Dualling Dalraddy Slochd Tier 1 junction Location and Layout Sifting Report. The key stages and outputs from the sifting exercises are outlined in the following sections of this report.

3.1.27. Four locations for grade separated junctions were considered during the initial stages of option development as presented in Image 3.1.1. These locations were identified from initial work undertaken as part of the PES and from early stakeholder consultation. The locations identified were:

- Aviemore South (vicinity of the existing junction with the B9152)
- Aviemore Central (between Aviemore and the Craigellachie Nature Reserve)
- Granish (vicinity of the existing junction with the A95)
- Black Mount (vicinity of existing junction with the B9153)

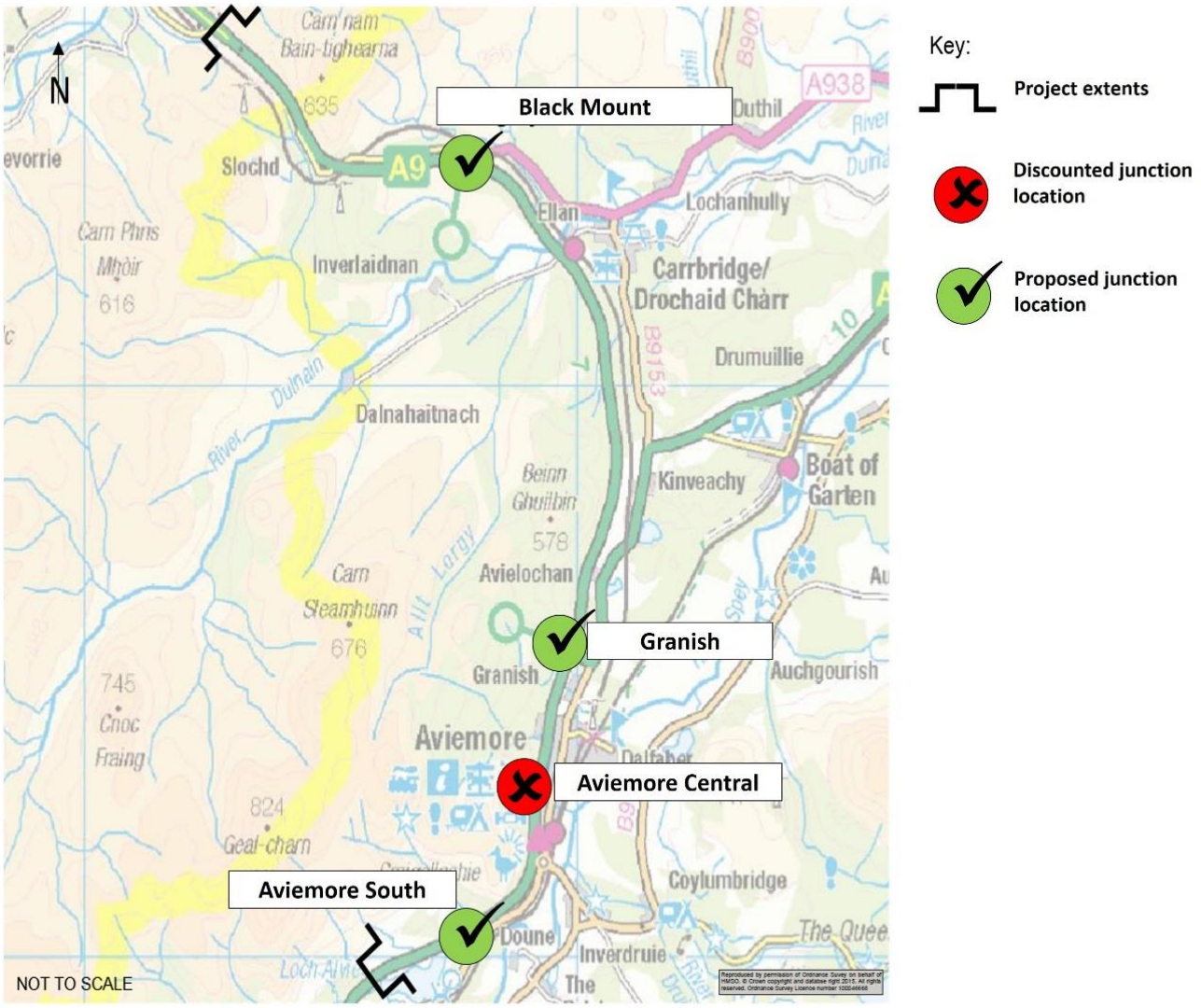

Image 3.1.1 Grade Separated Junction Locations

3.1.28. The junction at the Aviemore Central location was considered as a potential alternative to the Aviemore South junction with the following combinations as listed below evaluated as part of the junction location sift:

- Aviemore South
- Aviemore Central (alternative to Aviemore South)
- Combination of Aviemore South and Aviemore Central with potentially restricted movements.

3.1.29. Following a technical review as part of the initial sifting exercise, all options at Aviemore Central, including the combination with Aviemore South were discounted from further consideration due to a number of key factors which included:

- Encroachment into the Craigellachie National Nature Reserve and Site of Special Scientific Interest
- Impact on ancient woodland
- Significant earthworks/constructability issues
- Impact on Non-Motorised User network (incl. Aviemore Orbital Path)
- Comments received from public at public exhibitions held in February 2016 support assessments undertaken by project team regarding Aviemore South

3.1.30. For the purposes of this Stage 2 assessment three junction locations are considered:

- Aviemore South
- Granish
- Black Mount

Junction Layouts

3.1.31. A substantial number of different junction layouts were considered for each location as part of the initial stages of option development and evaluated as part of the sifting exercise. As a consequence of the topography and unique physical and traffic demands of each junction location, individual junction layouts were developed in order to ensure a sufficiently robust design was carried forward for initial review, prior to sifting.

3.1.32. A total of 40No. layouts were developed for Aviemore South junction location with 7No. taken into sifting after initial review. 31No. layouts were developed for Granish junction location with 10No. northbound options taken into sifting. At this location it was agreed that any layouts brought through for Stage 2 assessment would have an equivalent northbound and southbound widening option assessed. At Black Mount, 40No. layouts were developed, with 16No. taken forward to sifting covering both northbound and southbound widening options.

3.1.33. Junction layouts incorporating roundabouts were included as options at each of the locations. However it was found that in terms of landscape fit and the need for street lighting that they were generally less viable options for taking forward to assessment at the locations of Aviemore South and Black Mount which had a more rural setting.

3.1.34. It should be noted that the junction layouts included within this Stage 2 assessment are based on a representative design of a particular junction layout type, in the knowledge that they could revert to another variation of that form at Stage 3 should further information become available with respect to specific constraints or opportunities. Similarly, all the junction layout options have been developed such that they do not preclude an access connection to the northbound side of the A9, should this be identified as required during Stage 3. The junction layouts which have been taken through the sifting exercise and identified for inclusion within the Stage 2 assessment are detailed within the following sections.

Aviemore South

3.1.35. A total of 7 junction layouts were evaluated as part of the sifting exercise which are all based on a southbound mainline widening option. Layout options which required an underbridge (bridge under the A9) were discounted, as the A9 alignment would have to be raised significantly to achieve the required headroom within the underpass. This would require a much greater volume of earthworks increasing the footprint of the junction, impacting on adjacent properties and encroachment into agricultural land and semi-natural ancient woodland. It was recommended that the following 3 junction layouts are taken forward as Stage 2 options as listed below and presented in Images 3.1.2 to 3.1.4:

- Junction Layout A02 – Half Cloverleaf (Quadrants 1&4)
- Junction Layout A09 – Diamond Left-Right Stagger
- Junction Layout A18 – Diamond Left-Right Stagger with B9152 Realigned

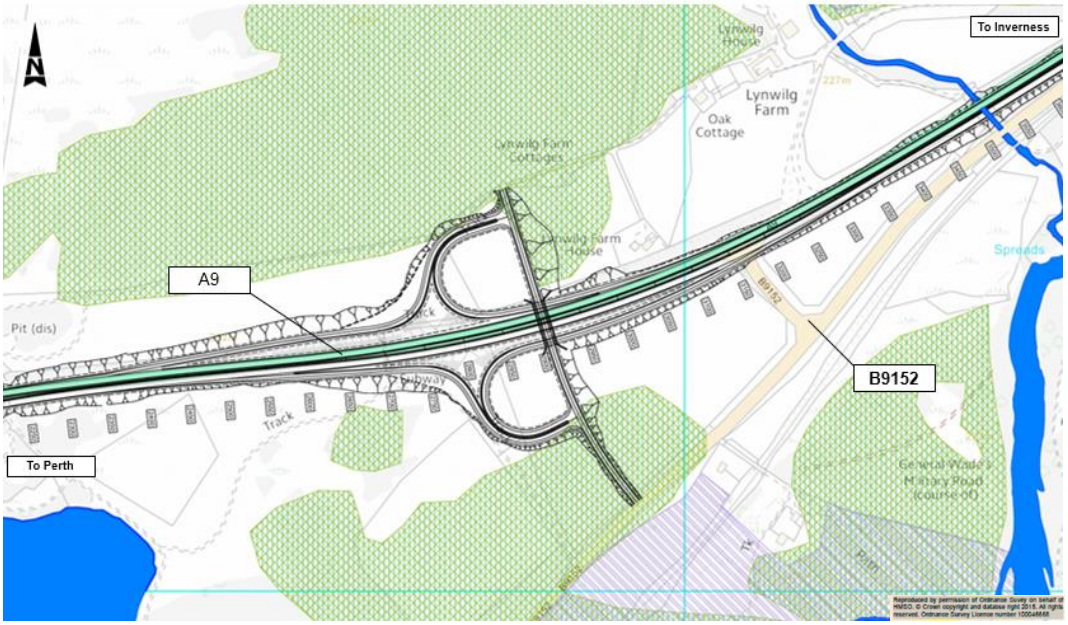

Image 3.1.2 Junction Layout A02 – Half Cloverleaf (Quadrants 1&4)

Image 3.1.3 Junction Layout A09 – Diamond Left-Right Stagger

Image 3.1.4 Junction Layout A18 – Diamond Left-Right Stagger with B9152 Realigned

3.1.36. Junction Layout A02 – Half Cloverleaf (Quadrants 1&4)

A02 is a half cloverleaf and maintains the existing alignment and priority for local traffic on the B9152 and therefore does not introduce any new conflict points at the existing at-grade junction. It is noted that there are no residential properties or sensitive receptors located within close proximity (50m) of the layout. The form of the overbridge is expected to be of simple structural form with potential for single span square overbridge structure.

Refer to Figure 4.4 in Volume 2 of this report.

3.1.37. Junction Layout Junction Layout A09 – Diamond Left-Right Stagger

A09 is a diamond with a left right stagger and as per layout A02, maintains the existing alignment and priority for local traffic on B9152. However, there is greater potential for landscape and visual integration on account of the linear form of layout. There is also potentially greater opportunity for opening up views to Loch Alvie and beyond and this layout is considered to be generally less visually intrusive than half cloverleaf type arrangements. The form of the overbridge is expected to be of simple structural form with potential for single span square overbridge structure.

Refer to Figure 4.5 in Volume 2 of this report.

3.1.38. Junction Layout Junction Layout A18 – Diamond Left-Right Stagger with B9152 Realigned

A18 is a diamond with a left right stagger with the B9152 realigned providing a generally smoother and free flow alignment between the A9 and B9152. This layout is however anticipated to alter priority in line with the predominant traffic movements which is between the A9 trunk road and the B9152. The overbridge is expected to be a more complex structural form with potential for three span square overbridge structure due to the skew angle of the bridge and the subsequently larger span than for A02 and A09 layouts.

Refer to Figure 4.6 in Volume 2 of this report.

Granish

3.1.39. A total of 10 junction layouts were evaluated as part of the sifting exercise. Options which utilised an overbridge (bridge over the A9) were sifted out, as the existing A95 alignment is currently below that of the A9 and so it would be impossible for the A95 geometry to comply with design standards with respect to vertical gradients if raised to the required level for an overbridge. It was recommended that the following 4No. junction layouts are taken forward as Stage 2 options as listed below and presented in Images 3.1.5 and 3.1.6:

Northbound mainline widening

- Junction Layout C18– Diamond Left-Right Stagger
- Junction Layout C21– Half Dumbbell / Clover Leaf

Southbound mainline widening

- Junction Layout C31 – Diamond Left-Right Stagger
- Junction Layout C34 – Half Dumbbell / Clover Leaf

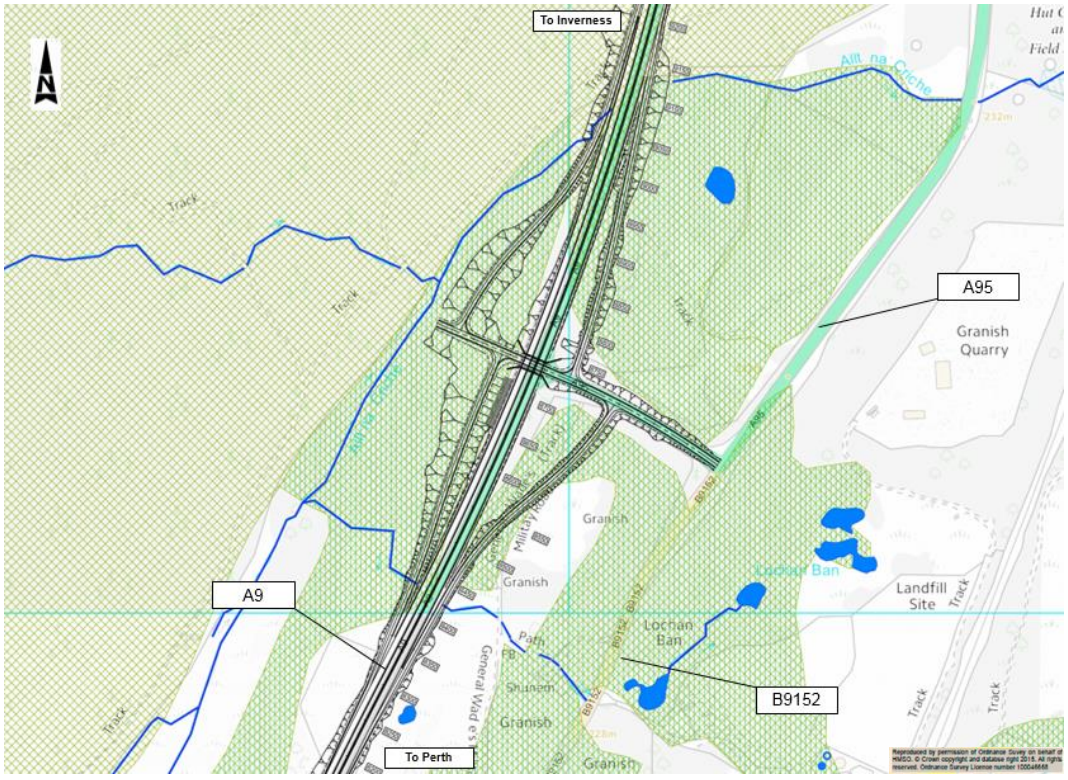

Image 3.1.5 Junction Layout C18 & C31– Diamond Left-Right Stagger

Image 3.1.6 Junction Layout C21 & C34– Half Dumbbell / Clover Leaf

3.1.40. Junction Layout C18 / C31 – Diamond Left-Right Stagger

Junction Layouts C18 (NB) and C31 (SB) are diamonds with a left right stagger. These layouts maintain the priority of the existing at-grade junction between the B9152 and A95, whereby the B9152 to A95 acts as the through route. The structural form of the underbridge is expected to be of simple form with the potential for single span square underbridge structure. Refer to Figure 4.7 and 4.9 in Volume 2 of this report.

3.1.41. Junction Layout C21 / C34 – Half Dumbbell / Clover Leaf

Junction Layouts C21 (NB) and C34 (SB) are a half dumbbell and cloverleaf arrangement. These layouts, as with the diamonds, maintain the priority of the existing at-grade junction between the B9152 and A95, whereby the B9152 to A95 acts as the through route. The roundabout layout was identified for this location as it offered a more compact solution mitigating impact to an adjacent residential property located to the south east of the junction and also encroachment into semi-natural ancient woodland. As with C18 and C31, the structural form of the underbridge is expected to be of simple form with the potential for single span square underbridge structure. Refer to Figure 4.8 and 4.10 in Volume 2 of this report.

Black Mount

3.1.42. A total of 12 junction layouts were evaluated as part of the sifting exercise; options which required an underbridge were discounted, as the A9 alignment would have to be raised significantly to achieve the required headroom within the underpass resulting in increased mainline earthworks and footprint. In addition the poor ground conditions in this area and the difficulty with draining an underpass structure made this structural solution prohibitive. It was recommended that the following 6 junction layouts are taken forward as Stage 2 options as listed below and presented in Images 3.1.7 to 3.1.9:

Northbound mainline widening

- Junction Layout D02 – Diamond Left-Right Stagger
- Junction Layout D07 – Half Cloverleaf (Quadrants 2&4)
- Junction Layout D13 – Restricted Movements Diamond

Southbound mainline widening

- Junction Layout D12 – Diamond Left-Right Stagger
- Junction Layout D51 – Half Cloverleaf (Quadrants 2&4)
- Junction Layout D03 – Restricted Movements Diamond

Image 3.1.7 Junction Layout D02 & D12 – Diamond Left-Right Stagger

Image 3.1.8 Junction Layout D07 & D51 – Half Cloverleaf (Quadrants 2&4)

Image 3.1.9 Junction Layout D03 & D13 – Restricted Movements Diamond

3.1.43. Junction Layout D02 / D12 – Diamond Left-Right Stagger

Junction layouts D02 and D12 are diamond with a left right stagger. The structural form of the overbridge is expected to be of simple structural form with potential for single span square overbridge structure.

Refer to Figure 4.11 and 4.14 in Volume 2 of this report.

3.1.44. D07 / D51 – Half Cloverleaf (Quadrants 2&4)

Junction layouts D07 and D51 are half cloverleaves. The structural form of the overbridge is expected to be of simple structural form with potential for single span square overbridge structure.

Refer to Figure 4.13 and 4.16 in Volume 2 of this report.

3.1.45. Junction Layout D03 / D13 – Restricted Movements Diamond

Junction layouts D03 and D13 are restricted movement diamonds, with dedicated north facing slip roads provided. These layouts were developed to cater for the dominant traffic movements identified between the A9 and A938 at this location. Based on traffic survey data, these movements consist of vehicles travelling northbound on the A938 joining the A9 northbound and alternatively vehicles travelling southbound on the A9 exiting to continue southbound on the A938 towards Carrbridge. The inclusion of the restricted movement junction at Black Mount is noted to have an impact on certain turning manoeuvres.

3.1.46. The structural form of the overbridge is considered to be consistent with the full movement junctions and expected to consist of a simple structural form with the potential for a single span square overbridge structure.

Refer to Figure 4.12 and 4.15 in Volume 2 of this report.

Summary

3.1.47. In total, 54 combinations of mainline alignment and junction layout have been considered for the purposes of traffic and economic assessment as part of this Stage 2 assessment and as reported in Part 4. These are summarised in Table 3.1.2a to c.

Table 3.1.2a: Mainline and junction layout option combinations for the purposes of traffic and economic assessment.

Mainline Alignment	Junctions			Option Reference
	Aviemore South	Granish	Black Mount	
Mainline Option 1 (predominantly widening on southbound side)	A02	C31	D12	**Option 1 A02- C31-D12**
			D51	**Option 1 A02-C31-D51**
			D03	**Option 1 A02-C31-D03**
		C34	D12	**Option 1 A02-C34-D12**
			D51	**Option 1 A02-C34-D51**
			D03	**Option 1 A02-C34-D03**
	A09	C31	D12	**Option 1 A09-C31-D12**
			D51	**Option 1 A09-C31-D51**
			D03	**Option1 A09-C31-D03**
		C34	D12	**Option 1 A09-C34-D12**
			D51	**Option 1 A09-C34-D51**
			D03	**Option 1 A09-C34-D03**
	A18	C31	D12	**Option 1 A18-C31-D12**
			D51	**Option 1 A18-C31-D51**
			D03	**Option 1 A18-C31-D03**
		C34	D12	**Option 1 A18-C34-D12**
			D51	**Option 1 A18-C34-D51**
			D03	**Option 1 A18-C34-D03**

Table 3.1.2b: Mainline and junction layout option combinations for the purposes of traffic and economic assessment.

Mainline Alignment	Junctions			Option Reference
	Aviemore South	Granish	Black Mount	
Mainline Option 1A (predominantly widening on southbound side, with a short northbound widening section near Aviemore)	A02	C31	D12	**Option 1A A02- C31-D12**
			D51	**Option 1A A02-C31-D51**
			D03	**Option 1A A02-C31-D03**
		C34	D12	**Option 1A A02-C34-D12**
			D51	**Option 1A A02-C34-D51**
			D03	**Option 1A A02-C34-D03**
	A09	C31	D12	**Option 1A A09-C31-D12**
			D51	**Option 1A A09-C31-D51**
			D03	**Option1A A09-C31-D03**
		C34	D12	**Option 1A A09-C34-D12**
			D51	**Option 1A A09-C34-D51**
			D03	**Option 1A A09-C34-D03**
	A18	C31	D12	**Option 1A A18-C31-D12**
			D51	**Option 1A A18-C31-D51**
			D03	**Option 1A A18-C31-D03**
		C34	D12	**Option 1A A18-C34-D12**
			D51	**Option 1A A18-C34-D51**
			D03	**Option 1A A18-C34-D03**

Table 3.1.2c: Mainline and junction layout option combinations for the purposes of traffic and economic assessment.

Mainline Alignment	Junctions			Option Reference
	Aviemore South	Granish	Black Mount	
Mainline Option 2 (a combination of northbound and southbound widening)	A02	C18	D02	**Option 2 A02-C18-D02**
			D07	**Option 2 A02-C18-D07**
			D13	**Option 2 A02-C18-D13**
		C21	D02	**Option 2 A09-C18-D02**
			D07	**Option 2 A09-C18-D07**
			D13	**Option 2 A09-C18-D13**
	A09	C18	D02	**Option 2 A18-C18-D02**
			D07	**Option 2 A18-C18-D07**
			D13	**Option 2 A18-C18-D13**
		C21	D02	**Option 2 A02-C21-D02**
			D07	**Option 2 A02-C21-D07**
			D13	**Option 2 A02-C21-D13**
	A18	C18	D02	**Option 2 A09-C21-D02**
			D07	**Option 2 A09-C21-D07**
			D13	**Option 2 A09-C21-D13**
		C21	D02	**Option 2 A18-C21-D02**
			D07	**Option 2 A18-C21-D07**
			D13	**Option 2 A18-C21-D13**

3.2. Cost Estimates

3.2.1. Cost estimates have been prepared for each of the 54 mainline and junction option combinations. To establish the cost estimate for each option, the scheme was broken down into key components (e.g. structure, mainline section or side road). For each component a bill of quantities was prepared for each significant cost item.

3.2.2. The rates utilised in the bill of quantities were initially based upon 'SPON's Civil Engineering and Highway Works Price Book' 2012 (these were adjusted to Q3 2014 prices utilising the Transport Scotland Price-Base Conversion tool). Following a review of the estimate at the Value for Money Workshop on 29th June 2016, the SPONS rates were adjusted where they were considered unrepresentative for this scheme.

3.2.3. The estimates for each option have been adjusted to include for inflation to reflect potential increases in costs between Q3 2014 to Q4 2022 when the A9 Dalraddy to Slochd scheme is assumed to start construction on site.

3.2.4. The estimate includes a number of significant determined costs, as listed below, but excludes any O&M cost provisions:

- Design and preparation costs;
- Land acquisition, legal fees and compensation;
- Supervision;
- Preliminaries;
- Public Utility diversion costs;
- VAT;
- Project Risk and Opportunity assessment;
- Programme Risk and Opportunity assessment;
- Optimism Bias; and
- Inflation.

3.2.5. To aid consistency Transport Scotland has developed a quantified risk assessment proforma to consider risk and opportunity to be applied across the A9 Dualling programme. This approach has been applied at a programme level to consider the risks / opportunities that may affect all projects on the A9 programme and at a project level, to consider risks / opportunities that may be specific to an individual project.

3.2.6. The methodology considers the potential cost/benefit to the project of each risk/opportunity, how likely they are to occur and how these can be mitigated. During Stage 2, the risks and opportunities identified and used for the assessment are applicable to all options. The estimates below include for the most likely (mid-range) quantified risk/opportunity outcomes.

3.2.7. The figures presented within Table 3.2.1. below are estimates based upon preliminary designs and comprise the Direct Cost of Construction adjusted for Risk, Optimism Bias, Inflation and Value Added Tax (VAT) (VAT applied for works outside the Highway Boundary). The Direct Cost of Construction includes for scheme preparation costs and physical construction of the works, which were determined from cost rates applied to determined quantities.

3.2.8. Optimism Bias is the recognised way of adjusting cost estimates to account for a tendency towards underestimation. Scottish Transport Appraisal Guidance (STAG) advises that "Adjustments for Optimism Bias may be reduced over time as more reliable costs are developed and project specific risk work is undertaken" (reference STAG Technical Database paragraph 13.3.2).

3.2.9. At DMRB Stage 2, Transport Scotland suggests an Optimism Bias of 25% is used for roads and this is considered to be the "maximum" figure for cost estimating purposes. The Transport Scotland suggestion of 15% for Stage 3 (the subsequent stage) is taken as the "minimum" figure.

3.2.10. For this project, an adjusted Optimism Bias was calculated as 22% taking account of stakeholder requirements, accuracy of cost estimates and project/risk management, and as such this value is taken as the "most likely" figure.

3.2.11. The estimates for each option have been adjusted to include for an assumed inflation figure of 36.7% to reflect potential increases in costs between Q3 2014 to Q4 2022 when the Dalraddy to Slochd project is estimated for construction to start. The date for construction start was determined from "A9 Dualling Programme Outline Business Case Supporting Data for Basis of Estimate Report v3.0, May 2014". It is noted that the construction start date is subject to change and will be dependent on the procurement methodology applied, taking cognisance of other A9 dualling projects.

3.2.12. The VAT allowance has been based upon an assessment of the value of the works which are to be constructed out with the existing highway boundary. VAT is not applied to works which are undertaken within the existing highway boundary.

Table 3.2.1: Cost Comparison of Options.

Option	Cost Est Range (£ M)		Lowest Price Option	Highest Price Option
	Plausible Minimum Cost	Plausible Maximum Cost		
Option 1	£563M	£680M	A02-C34-D03	A09-C31-D12
Option 1A	£566M	£684M	A02-C34-D03	A09-C31-D12
Option 2	£588M	£700M	A02-C18-D13	A09-C21-D02

3.2.13. The plausible minimum cost is based on the cheapest junction option combination in each mainline option, and the lowest value of project risk, programme risk and optimism bias whilst the maximum value is based on the greatest value for these variables applied to the most expensive junction option combination within each mainline option.

- Option 2 is the most expensive, as this option contains the highest volume of retaining walls
- Option 1 is slightly cheaper than Option 1A due a slightly reduced earthworks volume requirement
- Junction layouts featuring a half-cloverleaf are cheaper than diamonds as both on and off slips can be accommodated within the same embankment, thus saving on earthworks costs.

3.3. References

3-1 Option Sifting Document AP12-AMJ-GEN-X_ZZZZZ_ZZ-RP-ZZ-002.

3-2 Regulatory Method (WAT-RM-08) Sustainable Urban Drainage Systems (SUDS or SUD Systems) (SEPA, Version:v5.2 2014).

Part 2: Engineering Assessment

4. Engineering Overview

4.1 Introduction

4.1.1. This chapter presents an overview of the relevant engineering design considerations in relation to the scheme.

4.1.2. The engineering assessment is presented in Chapter 5.

4.1.3. The engineering assessment considers each option independently. However, as all the mainline and junction options are quite similar, it has been identified that for presentation of the assessment criteria referred to in Chapter 5 that a number of these will be considered together.

4.2. Design Considerations

4.2.1. The following physical features have been taken into consideration during the design process:

- Property and local communities: the route options have been developed to minimise the potential impact on communities;
- Topography: the horizontal and vertical alignments have been designed to be as close to the existing A9 carriageway as possible to minimise the earthworks embankments and land take along the corridor;
- Highland Mainline railway: following discussion with Network Rail, the design of the rail crossing at Slochd Beag will take into account future improvements with respect to span and pier arrangement, noting that headroom is not a constraint here for the A9 due to the significant difference in level between A9 and track levels;
- Public Utilities;
- The Cairngorms National Park Authority (CNPA) Local Development Plan (IMFLDP): the CNPA local development plan gives consent to the construction of housing adjacent to the A9 corridor to the west of Aviemore village;
- Environmental constraints: in addition to Craigellachie National Nature Reserve (NNR) Site of Special Scientific Interest (SSSI), Tor Beag Scheduled Monument, tributaries of the River Spey Special area of Conservation (SAC), Slochd Summit Geological Conservation Review Site (GCR) and the Cairngorms National Park, there are a number of non-designated assets, including ancient woodland and priority peat habitats. In general the development of options has sought to avoid environmental impacts where possible; and
- Earthworks: Earthworks for mainline options have been developed with varying steepness of side slopes, common across all options to take due consideration of landscape “fit” where other constraints do not present limitation. For the purposes of Junction design and assessment, all side slopes have been developed at 1 vertical to 3 horizontal ratio to ensure a comparative assessment may be made between options.

4.3. Design Approach

4.3.1. The preliminary designs for each of the mainline and junction options have been carried out in accordance with the DMRB and the preferred option will be developed further in the Stage 3 assessment which will follow. The following design criteria have been applied to designs for the purposes of this assessment.

Road Design

4.3.2. The DMRB design standards used as part of this assessment include:

- TD 9/93 Highway Link Design;
- TD 27/05 Cross Sections and Headrooms;
- TD 19/06 Requirement for Road Restraint Systems;
- TD 69/07 The Location and Layout of Lay-bys and Rest Areas;
- TD 22/06 Layout of Grade Separated Junctions;
- BD 2/12 Technical Approval of Highway Structures;
- TD 41/95 Vehicular Access to All Purpose Trunk Roads; and
- TD 42/95 Geometric Design of Major/Minor Priority Junctions.

Mainline

4.3.3. The DMRB Stage 1 Report concluded that the A9 Dualling strategy was to be a Category 7A All-Purpose Dual Carriageway in accordance with Table 4 of TD9/93: Highway Link Design, with a 120kph Design Speed.

4.3.4. Figure 4.3a of TD 27/05: Cross-Sections and Headrooms, (DMRB Volume 6) identifies the required cross section associated with a Dual 2 lane All Purpose Carriageway (D2AP) road as being two carriageways with, 2.5m nearside verge, 1.0m nearside hardstrip, 7.3m carriageway and a 1.0m offside hardstrip. These two carriageways are separated by a 2.5m wide central reserve. Section 3.18 of TD 9/93 identifies that verges and the central reserve can require significant widening to accommodate sight lines which can significantly increase the road cross section on lower horizontal radii.

4.3.5. The application of any widening has been achieved at a rate of 1 in 55 as outlined in Table 4/3 of TD 27/05. In the central reserves an assumption that Vehicle Restraint Systems (VRS) will be required in accordance with section 3.57 of TD 19/06 has been made. Where central reserves are wider than 10m, provision of a VRS will be reviewed during Stage 3.

4.3.6. At Stage 3 it may be feasible to allow relaxations to be considered, however relaxations are not permitted under section 1.26 of TD 9/93 on the approach to a junction. As lay-bys also create conflicting vehicle manoeuvres, under TD 9/93 these are also considered as junctions. The provision and location of lay-bys will be considered at Stage 3.

4.3.7. The design of the local roads have been developed based on the DMRB TD9/93 – Highway Link Design. As the project progresses through the DMRB Stage 3 assessment, more detailed alignments will be agreed with The Highland Council taking account of the guidance outlined in The Highland Council's Roads and Transport Guidelines for New Developments 2013.

4.3.8. The minimum headroom clearance for underbridges has been assumed to be 5.3m in accordance with Table 6-1 of TD 27/05.

4.3.9. The minimum headroom clearance for overbridges has been taken to be 6.45m, with additional clearance allowance made for vertical curvature of the overbridge where necessary, in accordance with Table 6-1 of TD27/05 for “high load routes”.

Junctions

4.3.10. As the A9 dualling is to be designed to a Category 7A road, with only grade separated junctions permitted and isolated left in/left out accesses, all the existing junctions on this section of road require to be upgraded or closed.

4.3.11. The junction layouts subject to this assessment have been developed in accordance with DMRB TD22/06 and allow local and strategic connections. The junction layouts for the preferred option shall be developed further in the DMRB Stage 3 assessment.

Drainage

4.3.12. The initial drainage design has been carried out in accordance with the DMRB and potential locations of outfalls and Sustainable Drainage Systems (SUDs) have been identified. The rationale for SUDS proposals is explained in chapter 5.

Earthworks

4.3.13. A desk study of the likely ground conditions has been undertaken. The geotechnical assessment was based on the Preliminary Sources Study Report prepared by Jacobs in 2013 with a continuation of this report prepared in 2016 by AMJV. This was further supplemented by field walkovers and consultation with statutory authorities. Key data sources include but are not limited to:

- British Geological Survey (BGS) 1:50,000 geological map;
- Ordnance survey 1:25,000 scale maps;
- Groundwater vulnerability Map of Scotland 1:625,000;
- Zetica unexploded ordnance risk map;
- BGS and other historical borehole records from various ground investigations including;
    - 1973 Slochd to Dalmagarry Investigation
    - 1977 South Aviemore to Granish ground investigation
    - 1977 Granish to Avielochan ground investigation
    - 1978 Kingussie to South Aviemore ground investigation
    - 2009 A9 Carrbridge WS2+1 Scheme
    - 2009 A9 Slochd WS2+1 Scheme
- Historical mapping;
- Topographic mapping;
- Aerial photography;
- Site visits; and

- Peat probing carried out across the site in August 2015.

4.3.14. The geotechnical assessment was used to determine the earthworks slopes to be implemented in the designs. Variable slopes have been applied to the mainline options in order to provide an improved landscape fit. At junction locations, all junction options have been developed on the basis of 1 vertical in 3 horizontal (1V in 3H) slopes at this stage of the assessment. A further more detailed review of landforms within the corridor to inform integrated earthworks and landscape design will be considered as the preferred option is developed at Stage 3.

4.3.15. All earthworks described in this report shall be developed to comply with the DMRB (and Eurocodes where applicable). At this stage of the scheme development it is envisaged that Departures from Standard may be required in relation to retention of existing earthworks which are unaffected by the widening.

4.3.16. The potential for re-use of excavated material within the works and potential material acceptability has been assessed and is discussed in the geotechnical assessment of each route and junction option.

Pavement Design

4.3.17. The initial pavement design has been undertaken to allow cost estimates to be completed. Following in service performance issues related to generic and proprietary stone mastic asphalts within Scotland, Transport Scotland has developed the TS2010 surface course specification to improve their performance and durability, therefore its use has been assumed for the mainline A9 and junction slip roads. Hot Rolled Asphalt has been assumed for the local roads as required by The Highland Council. Re-use of existing pavement as part of the proposed options has not been considered at this stage and full pavement construction has been assumed.

4.3.18. The design standards referenced for the pavements for the purposes of cost estimates at this stage are:

- HD 24/06 Traffic Assessment;
- HD 26/06 Pavement Design; and
- TSIA 35/15:TS2010 Surface Course Specification and Guidance.

Structures

4.3.19. All structures described in this report shall be developed to comply with the DMRB (and Eurocodes where applicable). At this stage of the scheme development it is envisaged that Departures from Standard may be required in relation to headroom for proposed structures where they are adjacent to existing Network Rail structures. The necessity or otherwise for Departures from Standards will be confirmed during Stage 3. Outline designs for new structures have been developed in accordance with the DMRB and in particular the following technical guidance and design standards as applicable:

- Transport Scotland's TS Interim Amendment No.39. Use of Eurocodes for the Design of Bridges and Road Related Structures; and
- BA 41/98 The Design and Appearance of Bridges.

4.3.20. Structures will be required for grade separated junctions, local road crossings, railway crossings, river and watercourses crossings, and drainage features. Outline design options have been prepared for the proposed structures. These will be significant cost items. Refer to chapter 5 for details.

4.3.21. Various structural solutions are achievable for the horizontal alignments presented in this report and no significant alteration of the road alignment will be required to achieve a structural solution.

4.3.22. The proposed designs assume that all existing culverts will be replaced with a new structure and shall be designed for the 1 in 200 year flood peak discharge flow of the watercourse. This will be subject to further consideration as part of the full Stage 3 assessment.

Public Utilities

4.3.23. There are a number of buried and overhead utility services within the scheme limits (both public and private) including:

- British Telecom overhead and underground services;
- Scottish and Southern Electricity overhead and underground cables; and
- Scottish Water have water mains in the area and there are also private water mains.

Non-Motorised Users

4.3.24. An NMU Strategy has been established for the A9 Dualling Programme [Ref. 4-1] which considers the following:

- NMU facilities for both recreational and commuting purposes;
- Creation of a NMU network which would facilitate sustainable transport, walking and cycling initiatives;
- An assessment of each existing NMU route in relation to engineering, environment and economic criteria and determine if they can be incorporated in the scheme;
- The Equality Act 2010 through the application of 'Roads for All, A Good Practice Guide for Roads';
- Combining NMU facilities for different types of NMUs; and
- Review the NCN routes and ensure continuity of the route if affected by the Proposed Scheme.

4.3.25. The Stage 2 assessment reports on the potential impacts of options on existing NMU facilities in Part 3, Chapter 17 and the design and mitigation surrounding new NMU infrastructure will be developed in detail at Stage 3.

Lay-bys

4.3.26. The SEA identified 12No. potential enhanced lay-by sites across 7No. locations which have been considered as having potential and merit further review. These sites will be considered further at DMRB Stage 3 with regards to engineering and environmental constraints and to also identify the potential to accommodate additional space for interpretation and/or art features.

4.3.27. The locations listed below have not been developed in detail at this stage and have not been considered as part of the options assessment:

Craigellachie NNR

- Access to Craigellachie National Nature Reserve;
- Opportunity for signage and information panels regarding the local flora and fauna;
- Potential effects on Craigellachie SSSI and NNR would have to be carefully considered, as would encroachment on ancient woodland.

Ch. 13500 to 15000; Torr Mhuic to Crannaich

- Potential views down A9 to Aviemore and Cairngorm Massif;
- Access to Kinveachy Forest and NCN7;
- Opportunity for signage and information panels regarding General Wade's Military Road;
- Encroachment onto ancient woodland would have to be carefully considered.

Ch. 17000 to 17400; Crainnaich to Carrbridge

- Potential views down A9 to Aviemore and Cairngorm Massif;
- Potential access to Carrbridge, with opportunity for signage and information panels regarding the original Carr Bridge;
- Encroachment onto ancient woodland would have to be carefully considered Slochd;
- Potential views down A9 to Aviemore and Cairngorm Massif;
- Potential for access to NCN7 and cross-country ski centre;
- Potential views of the Soldier's Head rock formation;
- Opportunity for signage and information panels regarding the Slochd GCR;
- Encroachment onto Slochd GCR would have to be carefully considered.

4.3.28. In addition to potential enhanced lay-by provisions, standard lay-by locations shall be developed in accordance with TD69/07 and in line with the lay-by strategy for the A9 during DMRB Stage 3 development. Based on initial consultation with bus operators, it is unlikely there will be a requirement for bus lay-bys on the mainline.

4.4. References

4-1 NMU Access Strategy, May 2016

http://www.transport.gov.scot/system/files/documents/projects/A9/A9%20Non%20Motorised%20Users%20Access%20Strategy%200516_0.pdf

5. Engineering Assessment

5.1. Introduction

5.1.1. This chapter of the report presents the engineering assessment of the DMRB Stage 2 route options for the A9 Dalraddy to Slochd Dualling.

5.1.2. The assessment considers the constraints as listed below, identifying key factors where applicable to differentiate mainline and junction options. It also provides a summary of the main factors associated with each of the constraints and sets out the scope of work required at DMRB Stage 3.

- Standards;
- Topography;
- Land Use;
- Hydrology;
- Geotechnics;
- Earthworks;
- Structures;
- Public Utilities;
- Constructability;
- Operation and Maintenance; and
- Non-Motorised Users.

5.1.3. The proposed mainline and junction options being subject to assessment have been developed to an appropriate level of detail to enable evaluation, however, it is important to note that these are indicative designs. The preferred option at the conclusion of Stage 2 will be developed further during the DMRB Stage 3 as part of an iterative design process taking into account emerging findings from further field and survey work across all technical and environmental disciplines.

5.2. Engineering Constraints

5.2.1. Each of the mainline and junction options have been developed as outlined in chapter 4 and may impact on the following physical constraints to a greater or lesser degree as discussed in further detail in this report:

- The existing A9;
- All local junctions and accesses;
- Loch Alvie;
- The B9152 route;

- Allt na Criche and its associated floodplain;
- Highland Mainline railway;
- Kinakyle Farm;
- Loch Puladdern;
- Properties at Aviemore;
- Property at Granish;
- Properties at Carrbridge;
- River Dulnain and its associated flood plain;
- NCN7;
- Slochd Beag Bridge;
- Rock cuts at Slochd Mòr;
- Areas of peat; and
- Public Utilities.

5.3. Mainline

5.3.1. This section of the report provides an engineering description of the Mainline Options and the major engineering considerations that influenced their development.

Engineering Description of Mainline Options

5.3.2. The horizontal and vertical alignment geometry associated with each Mainline Option is demonstrated on the drawings in Figure 5.1 (Mainline Option 1), Figure 5.2 (Mainline Option 1a) and Figure 5.3 (Mainline Option 2) of Volume 2 of this report. Alignment reports in Appendices A.5-1 (Mainline Option 1), A.5-2 (Mainline Option 1a) and A.5-3 (Mainline Option 2) also detail the horizontal and vertical geometry. All mainline options are 25.03km in length.

5.3.3. Commencing from the southern tie in with the Kincraig to Dalraddy dualling scheme currently under construction (due to be completed in summer 2017), the geometry of the three Mainline Options diverges from the Allt an Fheàrna river crossing, at Ch.0. Option 2, the combination of northbound and southbound widening, describes a tighter radius curve to the south of the existing mainline. From Ch.1,400, Option 1 and 1A and Option 2 crossover, as Option 2 results in widening to the northbound side.

5.3.4. The three options converge at approximately Ch.3,300, before diverging again at approximately Ch.3,800, as Option 2 regains the northbound side. From Ch.4,300, Option 1 and Option 1A diverge, as Option 1A moves towards the northbound side. The 1:3 embankments of Option 2 encroaches onto the March Cottage property at Ch.4,600, it is proposed that a retained solution will be provided for Option 2 at this location. On the opposite side, Option 1 encroaches on the B9152 as it approaches Aviemore. To a lesser degree, Option 1A encroaches on both.

5.3.5. Option 1 and 1A converge from Ch.5,300, on the southbound side. Option 2 will require a rock cut into Craigellachie. At Ch.5,800, the embankment slopes of Option 2 encroach onto Loch Puladdern, which cannot be avoided by an engineered solution such as retaining structure or steepened earthworks.

5.3.6. Between Ch.7,300 and Ch.8,000, there are properties either side of the existing alignment, which the earthworks for all three options encroach upon. Option 1 and 1A require a much greater volume of earthworks at this location.

5.3.7. North of Granish, the Highland Mainline Railway runs to the east of the existing A9 alignment. The earthworks for the southbound options, 1 and 1A encroach onto the railway embankment at around Ch.11,700 and a retaining structure has been identified as being necessary to avoid this interface.

5.3.8. Through Carrbridge, Option 1 and 1a encroaches on a property to the east of the structure. It is anticipated that the new structure will be built to allow two-way traffic, prior to the existing crossing being refurbished.

5.3.9. A new crossing of Allt nan Ceatharnach (Baddengorm Bridge) will be required at Ch.17,800. There are few physical constraints at this location, and both southbound and northbound widening options will encroach on ancient woodland.

5.3.10. Beyond Ch.20,000 all three options converge, as only southbound widening is being considered at the Slochd Beag structure and through the Slochd Summit rock cut. The existing parapets on the Slochd Beag do not meet current design standards for new structures. It is yet to be determined whether or not Network Rail will require H4a parapets to be retrofitted to the structure. As with Dulnain, it is anticipated that the new crossing is built offline, before two-way traffic is diverted over the new structure to allow upgrade works to the existing.

5.3.11. Between Ch.23,800 and Ch.24,100 the new southbound carriageway will require either a sidelong viaduct, or a large supporting earthwork infill to the adjacent glen at Slochd Mòr. Both of these options are assessed in section 5.11 Structures. Between Slochd Mòr and the existing dual carriageway section, all three options are based on southbound widening.

5.3.12. Table 5.3.1 below provides a summary description of each Mainline Option.

Table 5.3.1: Engineering Description of Mainline Options.

Mainline Option	Description
1	Predominantly Southbound Widening • 26.1m wide D2AP carriageway • 1m hardstrips, 3.65m lanes, minimum 2.5m central reserve, 2.5m verges with some widening for visibility • Overall length 25.03km • Parallel widening to the southbound side of the existing A9 Ch 0 – 25,030m
1A	Predominantly Southbound Widening with localised variation south of Aviemore • 26.1m wide D2AP carriageway • 1m hardstrips, 3.65m lanes, minimum 2.5m central reserve, 2.5m verges with some widening for visibility • Overall length 25.03km Parallel widening generally to the southbound side of the existing A9 Ch 0 – 25,030m, with generally more symmetrical/northbound widening between Ch 3,500 and 5,500 to avoid direct impacts to residential properties.
2	Predominantly Northbound Widening • 26.1m wide D2AP carriageway • 1m hardstrips, 3.65m lanes, minimum 2.5m central reserve, 2.5m verges with some widening for visibility • Crossovers to localised southbound widening has been applied at sections 2 (Ch.2,500 to Ch.3,500), section 6a (Ch.10,400 to Ch.11,700) and sections 11 and 12 (Ch.20,900 to Ch.25,030) • Overall length 25.03km

Engineering Considerations of Mainline Options

5.3.13. The geometry of all the Mainline Options achieves a high level of compliance for a 120kph design speed with transition curves, vertical geometry and superelevation achieving full compliance with TD9/93 throughout. Adopted relaxations in standard associated with mainline horizontal curvature are detailed in section 5.6 of this report.

5.3.14. The Mainline Options provide a carriageway cross section of a Category 7A route as outlined in section 4.3. Application of the 120kph design speed requires a desirable minimum Stopping Sight Distance (SSD) of 295m which results in significant widening of verges and central reserves especially due to the horizontal reverse curves at several locations along the scheme length. A summary of the overall length of verge and central reserve widening required for each of the mainline options is included in Table 5.3.2.

Table 5.3.2: SSD Verge and Central Reserve Widening Requirements

Mainline Option	**Length Required of Verge Widening**	**Length Required of Central Reserve Widening**
Option 1 – Northbound	5950m *(Maximum width of 8.1m at Ch 10,900)*	7400m *(Maximum combined width of 18.25m at Ch 22,000m)*
Option 1 - Southbound	3850m *(Maximum width of 17.0m at Ch 21,990)*	5800m
Option 1a – Northbound	5150m *(Maximum width of 8.1m at Ch 10,900)*	6900m *(Maximum combined width of 18.25m at Ch 22,000m)*
Option 1a - Southbound	2250m *(Maximum width of 17.0m at Ch 21,990)*	2850m
Option 2 – Northbound	6950m *(Maximum width of 9.75m at Ch 10,920)*	12550m *(Maximum combined width of 18.25m at Ch 21,900m)*
Option 2 - Southbound	6200m *(Maximum width of 17.5m at Ch 21,980)*	11000m

5.3.15. The application of this widening has been achieved at a rate of 1 in 55 as outlined in Table 4/3 of TD 27/05. In the central reserve, an assumption that Vehicle Restraint Systems (VRS) will be required in accordance with section 3.57 of TD 19/06 has been made. Where central reserves are wider than 10m, provision of a VRS will be reviewed during Stage 3.

5.3.16. At Stage 3 it may be feasible to allow relaxations in SSD to be considered, however these relaxations are not permitted under section 1.26 of TD 9/93 on the approach to a junction. The proposed junctions detailed as part of the Stage 2 options are all considered as mainline junctions. As lay-bys also create conflicting vehicle manoeuvres, under TD 9/93 these are also considered as junctions. The provision and location of lay-bys will be considered at Stage 3.

Summary

5.3.17. The Mainline Options are based on southbound and northbound widening. Option 1 is southbound widening, Option 1A is predominantly southbound widening, barring a short section near Aviemore South to avoid conflicts with existing properties. Option 2 is predominantly northbound widening, barring sections where northbound widening has been sifted out, resulting in a composite option.

5.3.18. Mainline Option 1 has less excavated material and also requires less imported fill than Option 2, therefore Mainline 1 has lower capital costs. Additionally, Option 1 requires fewer retaining structures than both Options 1A and 2, resulting in a lower direct cost of construction.

5.3.19. As Option 1 has no crossovers of the existing A9 carriageway compared with two crossovers for Option 1A, and five crossovers for Option 2 it will therefore be easier to construct, with consequent benefits in safety, cost and disruption during construction.

Scope of Stage 3 Assessment

5.3.20. The Mainline alignment will be subject to further design refinement during Stage 3 in order to optimise the geometry to achieve the following:

- Improve earthworks balance;
- Minimise requirements for engineered solutions and retaining walls;
- Mitigate the need for design relaxations and/or departures within the specimen design; and
- Identify suitable locations for layby provisions, including enhanced facilities where practicable.

5.3.21. Costs associated with the mainline alignment will be reviewed and updated during Stage 3 to feed into the cost estimates.

5.4. Junctions Options

5.4.1. This section of the report describes the proposed new Grade Separated Junction (GSJ) locations, the layouts considered at each location, and the application of the junction strategy.

Consideration of Junction Locations

5.4.2. Junction locations identified from initial work undertaken as part of the PES have been evaluated and reviewed as part of a junction early sifting exercise with the three existing at-grade junctions with the A9 at the locations of Aviemore South, Granish and Black Mount justified as viable sites for the promotion of a GSJ

5.4.3. Refer to Section 3.1.24 for a detailed description of the junction locations.

Consideration of Junction Layouts

5.4.4. Preliminary junction layouts have been developed incorporating loop, diamond and dumbbell configurations. Due to local topography, Mainline Option earthworks and environmental considerations, it is proposed that these junctions would take the form of an overbridge configuration at Aviemore South and Black Mount and an underbridge at Granish.

5.4.5. All junction layouts developed at this stage incorporate a stub located on the west side of the junction for the purposes of providing a means of local access. These will be reviewed in more detail at Stage 3 as part of the Tier 3 assessment when local access proposals will be developed. Junction layouts will therefore be subject to refinement to take account of access requirements.

5.4.6. A summary of the junction layouts options being considered at each location is outlined in Table 5.4.1, with detailed descriptions included within Section 3.1.24.

Table 5.4.1: Junction Layout Options

Option Reference	Description
Aviemore South Junction Options	
A02	Half Clover leaf Quadrants 1&4 (overbridge/southbound mainline widening)- Sections 1&2 (applicable to all mainline options)
A09	Diamond Left-right Stagger with Ghost Island (overbridge/southbound mainline widening)- Sections 1&2 (applicable to all mainline options)
A18	Diamond Left-right Stagger with B9152 Realigned (overbridge/southbound mainline widening)- Sections 1&2 (applicable to all mainline options)
Granish Junction Options	
C18	Diamond (underbridge/northbound mainline widening)– Section 5 (applicable to mainline option 2)
C21	Half Dumbbell Clover leaf (underbridge/northbound mainline widening)– Section 5 (applicable to mainline option 2)
C31	Diamond (underbridge/southbound mainline widening)– Section 5 (applicable to mainline options 1 and 1A)
C34	Half Dumbbell Clover leaf (underbridge/southbound mainline widening)– Section 5 (applicable to mainline options 1 and 1A)
Black Mount Junction Options	
D02	Diamond with Left-right Stagger (overbridge/northbound mainline widening) – Section 9 (applicable to mainline option 2)
D03 (Restricted Movements)	Half Diamond (North Facing Slips) (overbridge/southbound mainline widening) – Section 9 (applicable to mainline options 1 and 1A)

Option Reference	Description
D07	Half Clover leaf Quadrants 2&4 (overbridge/northbound mainline widening) – Section 9 (applicable to mainline option 2)
D12	Diamond with Left-right Stagger (overbridge/southbound mainline widening) – Section 9 (applicable to mainline options 1 and 1A)
D13 (Restricted Movements)	Half Diamond (North Facing Slips) (overbridge/northbound mainline widening) – Section 9 (applicable to mainline option 2)
D51	Half Clover leaf Quadrants 2&4 (overbridge/southbound mainline widening) – Section 9 (applicable to mainline options 1 and 1A)

Summary

5.4.7. The junction strategy outlined in the PES highlighted that access to the newly dualled A9 would be via grade-separated junctions and potentially via left in/left out arrangements in exceptional circumstances.

5.4.8. All three mainline options are consistent in terms of junction provision and include for new grade separated junctions at the locations of Aviemore South, Granish and Black Mount.

5.4.9. The loop junction layouts have a smaller footprint and lower capital cost than the diamond layout alternative. This is because the on and off slips share the same ramp in a loop or cloverleaf arrangement, whereas a full-movements diamond layout requires four separate ramps.

5.4.10. The Black Mount junction location includes layouts for both full and restricted movements. The restricted movements layouts have been identified and developed based on the limited traffic volumes undertaking turning movements from the A9 northbound into Black Mount and also to the A9 in a southbound direction from Black Mount. It is acknowledged that although the traffic turning volumes are exceptionally low at Black Mount, in terms of the overall route operation on the A9, particularly with regards to winter resilience, maintenance and provision for private land access for major forestry that there is justification to include a full movement provision. In addition, feedback obtained from stakeholders and the general public from the consultation exhibitions indicates a strong preference towards a full grade separated junction accommodating all turning movements, supporting the assessment of the project team.

Scope of Stage 3 Assessment

5.4.11. The junction options will be subject to further design refinement during Stage 3 in order to consider:

- Optimising the earthworks balance;
- Adjusting side slope profiles to seek opportunities for improved landscape fit;
- Connections for accesses, covering private, agricultural and commercial requirements;
- NMU routes within the vicinity of the grade separated junctions to facilitate suitable routes and crossings of the A9 corridor; and
- Reduction in junction design standards.

5.4.12. Costs associated with the junction layouts will be reviewed and updated during Stage 3 to feed into the cost estimates.

5.5. Local Roads & Accesses

5.5.1. Within the scheme extents there are a number of local roads which run parallel to the A9 corridor as outlined in Table 5.5.1.

Table 5.5.1: Local Roads Summary

Road	Location	Description
B9152	Kingussie - Granish	Follows an alignment on the east side of the A9 (adjacent to the southbound carriageway) with at-grade junction connections with Aviemore South and Granish Junctions. Road passes through the centre of Aviemore and forms a key route and link for residential, commercial and tourist purposes.
B9153	Kinveachy - Carrbridge	Runs parallel with A9 (adjacent to the southbound carriageway) connecting between the A95 at Kinveachy and Carrbridge village. Route forms part of NCN7.
U2400 (unclassified)	Black Mount - Slochd	Follows an alignment adjacent to the southbound carriageway at Black Mount switching over to run adjacent to the northbound carriageway from Slochd Beag to Slochd summit. Route forms part of NCN7. The U2400 connects with the A9 at Slochd via an at-grade junction which will be subject to a separate Tier 2 junction assessment during the Stage 3 assessment.

5.5.2. The local road network has been assessed and considered to be mostly unaffected by the mainline widening options as the A9 is located in a corridor which will not impose on the local road network. Where the corridor is constrained by local roads, then the mainline widening will have an impact. Figures 7.1 and 7.2 show the encroachment on the B9152 by the proposed new mainline alignment earthworks.

5.5.3. The junction layouts however are points on the route where there is connections required with the local road network. The impact of the grade separated junction layouts on local roads is presented within Table 5.5.2.

Table 5.5.2: Local Roads Impact at Junctions

Location	Junction Option	Description	Impact
Aviemore South	A02	Half Cloverleaf (Quadrants 1&4)	Negligible: at-grade junction formed between B9152 and new junction link road.
	A09	Diamond Left-Right Stagger	
	A18	Diamond Left-Right Stagger with	Moderate: Realignment of the B9152 required over a length of approximately 900m to account for change in junction priority.

Location	Junction Option	Description	Impact
		B9152 Realigned	
Granish	C18	Diamond (Northbound)	Negligible: at-grade junction formed between B9152/A95 and new junction link road.
	C21	Half Dumbbell / Clover Leaf (Northbound)	
	C31	Diamond (Southbound)	
	C34	Half Dumbbell / Clover Leaf (Southbound)	
Black Mount	D02	Diamond Left-Right Stagger (Northbound)	Moderate: Realignment of the U2400 required over a length of approximately 640m. In addition the adjoining A938 will require to be realigned over a length of approximately 525m in order to accommodate a full grade separated junction layout at this location.
	D03	Restricted Movements Diamond (Southbound)	
	D07	Half Cloverleaf (Quadrants 2&4) (Northbound)	
	D12	Diamond Left-Right Stagger (Southbound)	
	D13	Restricted Movements Diamond (Northbound)	
	D51	Half Cloverleaf (Quadrants 2&4) (Southbound)	

5.5.4. As noted within section 2.3 there are a total of 32No. individual accesses currently connected into the A9 carriageway. As part of the dualling proposals it is the intention that direct accesses are minimised with alternative means of access provided by either combining a number of accesses together to tie-in with a new grade separated junction, form a bridge or underpass structure over the A9, promote a parallel link road or develop a left in left out junction layout for discrete accesses where no alternatives are available.

5.5.5. Existing accesses are being investigated as part of a separate Tier 3 assessment which will be reported as part of the Stage 3 assessment. At this current stage, consultations have been undertaken with all key landowners and estates to gain a full understanding of how each access is used and to inform the access strategy.

5.5.6. All mainline options and junctions at this stage are considered to have a generally equivalent impact on accesses with only marginal differences identified which are not considered to be differentiating factors.

Summary

5.5.7. The local road network is impacted by a number of the grade separated junctions where realignment is necessary. This impacts most notably at Aviemore South where junction layout option A18 requires the complete realignment of the B9152 to accommodate a change in junction priority. At the Granish location, all junction layouts have a negligible impact on the local road network. All junction layouts at Black Mount will require the realignment of the U2400 in order to accommodate the full grade separated junction provision. However as all the junction layouts at this location are equally affected, there is no differentiating factor.

5.5.8. Accesses will be considered in more detail at Stage 3.

Scope of Stage 3 Assessment

5.5.9. In conjunction with the development of the mainline geometry and junction layouts, the design of local roads and accesses will be progressed in more detail during Stage 3 based on the following:

- Continue consultation and engagement with all relevant parties affected by the use and operation of existing accesses;
- Develop the Tier 3 access strategy to identify feasible options for accesses and links to cater for private, agricultural and commercial operations;
- Develop Tier 2 access options for the junction at Slochd between the U2400 unclassified road and the A9;
- Engage with The Highland Council to review design requirements and standards applicable to the local road network;
- Consideration to design departures;
- Review of connections and tie-ins between proposed grade separated junctions and local roads to address concerns highlighted during stakeholder consultation; and
- Develop access tracks and set down areas to take account of future access requirements for SUDS drainage facilities and Transport Scotland ITS equipment.

5.6. Departures & Relaxations from Standard

5.6.1. The geometric design of roads adopts a hierarchical approach consisting of compliance with standard, relaxations from standard and departures from standard. The DMRB recognises in some situations coincident relaxations constitute a departure.

5.6.2. Generally relaxations from standard may be adopted at the discretion of the designer whilst departures from standard require formal approval from the Overseeing Organisation (typically Transport Scotland for Trunk Roads and the local authority, The Highland Council for all side roads within the project extents).

5.6.3. The assessment of whether relaxations or departures from standard are required is directly associated to the adopted design speed of the road as defined in TD 9/93 of the DMRB. The proposed design speeds of the roads which are envisaged to be classified will be identified and agreed during Stage 3 with Transport Scotland or The Highland Council as appropriate.

5.6.4. The preliminary designs of side roads have adopted a DMRB standard cross section of 7.3m carriageway with 1.0m hard strips. However, during consultations with The Highland Council, they have indicated that they may consider a 6.0m wide carriageway with no hard strips as an alternative cross section. If this is carried through to the Stage 3 design, a departure from standard would require to be granted which will be investigated further through consultation with The Highland Council and TS Standards Branch as appropriate.

5.6.5. Many of the existing side roads were constructed prior to the implementation of modern design standards. To achieve acceptable tie-ins it is likely that the new side roads will require departures from standard which will be considered in more detail at Stage 3.

5.6.6. Stage 2 options developed for the mainline and junctions achieve full compliance with the DMRB for horizontal geometry, vertical geometry, superelevation, SSD, visibility splays and junction layouts. These will however be subject to more detailed consideration at Stage 3.

Summary

5.6.7. All Stage 2 options are a similar standard of mainline geometry and achieve a fully compliant standard with no relaxations or departures identified. Similarly, all junction layouts have been developed to comply with the DMRB standards, with no departures identified or required to be promoted at this stage. These will however be reviewed as part of the design development during the DMRB Stage 3 assessment.

Scope of Stage 3 Assessment

5.6.8. As the mainline geometry and junction layouts are developed in more detail during Stage 3, identification of relaxations and departures will be prioritised to allow for appropriate consultations to be undertaken with Transport Scotland Standards Branch or The Highland Council early within the programme.

5.7. Topography and Land Use

5.7.1. Between the southern boundary of the scheme and the settlement of Carrbridge the existing A9 is located predominantly at grade within a broad strath, with the Monadhliath mountain range rising above Strath Spey to the west and the Cairngorm plateau to the east. North of Carrbridge, the existing A9 climbs towards Slochd summit, and the surrounding topography becomes characterised by steep mountain slopes and narrow river valleys, culminating in the pass at Slochd summit, which the existing A9 transits in a rock cut. From Slochd summit to the northern boundary of the scheme, the landscape is characterised by open moorland, and mountain plateaux.

5.7.2. All mainline and junction options introduce changes to the existing topography through the introduction of new road embankments and cuttings, grade separated junctions, local road realignments and structures.

5.7.3. For the mainline options, all are generally consistent in terms of geometry and have a similar earthworks balance, albeit Option 1 has the lowest requirement of the options for cut and fill volumes.

5.7.4. The areas of land adjacent to the A9 consists of a multiple of land uses with farmland present at the southern extents used for pasture, changing to commercial managed plantations and then opening up to moorland further north. Mainline Option 1 and 1a which are predominantly southbound widening offer the advantage of utilising land which is located between the existing A9 carriageway and the Highland Mainline railway. This area of land which extends along the east side of the A9 from Avielochan at mainline Ch11,000m to Black Mount at Ch19,300m has been identified by the landowner during initial consultations as being the preferred side to utilise for the dualling works. This is primarily because the land consists of a thin strip in several places which has been stated by the landowner as difficult to access and manage as part of a commercial operation.

5.7.5. The junction layouts proposed with the smallest landtake and earthworks requirements are considered to be more favourable in terms of integrating with the existing topography and minimising change and severance of land. On this basis, the following junctions are considered to be favourable:

Aviemore South: Option A02 - Half Clover leaf Quadrants 1&4

Granish: Option C21 & C34 - Half Dumbbell Clover leaf

Black Mount: Option D03 & D13 - Half Diamond (North Facing Slips)

Summary

5.7.6. The effects of the mainline and junction options on topography and land use are considered in detail within Part 3, Chapters 8 and 12.

5.7.7. Due to the similarity of the mainline options and junction layouts there is very little to differentiate the options, however the overall landtake and the classification and use of adjacent land act as distinguishing factors. On this basis, Mainline Option 1 would be favoured together with the associated junctions which utilise a loop layout.

5.7.8. It should be noted that at the Black Mount junction the layout with the lowest overall landtake is the restricted movements' junctions which utilise only north facing slip roads. Thereafter, the next lowest landtake junction is the cloverleaf layout.

Scope of Stage 3 Assessment

5.7.9. The DMRB Stage 3 assessment will include for a more detailed consideration of the earthworks balance and in particular investigate options for adjusting the side slopes of cuttings and embankments to provide improved landscape fit. In addition, further consideration will be given to the impact on properties, where they are potentially at risk of demolition or land-take.

5.8. Hydrology

5.8.1. The effects of the mainline and junction options on the water environment are considered in detail within Part 3, Chapter 10: Road Drainage and the Water Environment, which also included flood risk, hydromorphology and water quality.

5.8.2. This section provides a summary of the engineering assessment related specifically to watercourse crossings and road drainage.

Road Drainage

5.8.3. Preliminary road drainage designs have been developed for each of the mainline and junction options in order to identify catchment areas, potential outfall locations, and approximate sizing and location of sustainable drainage systems (SUDS) required for stormwater treatment and attenuation. The indicative location and type of the SUDS features is shown on the Environmental Figures 7.1 to 7.6 of Volume 3.

SUDS Rationale

5.8.4. Pre-earthworks drains (ditches where land take permits or filter drains) will be considered to control surface water run-off from embankments, cuttings, existing hillside etc. and where existing ground profiles require them to act as interception drains to prevent off-site runoff entering the road corridor.

5.8.5. Surface water from the proposed A9 embankment slopes will discharge to filter drains or ditches constructed at the toe of embankments. Additional earthworks drainage may be required where seepages are envisaged.

5.8.6. Surface water runoff arising from the proposed A9 dual carriageway will be subjected to a minimum of two levels of treatment. The first phase treatment will be achieved through the use of carriageway filter drains. Carriageway filter drains will also drain the sub-base material in cuttings. Further measures may be required to reduce seepage from filter drains in any areas of embankments, and to protect filter drains in areas of peat.

5.8.7. Attenuation SUDS, such as detention basins, retention ponds and infiltration basins will provide another level of treatment. Discharges to both surface water and groundwater are proposed, based on the existing road drainage discharge regime. Retention ponds will generally include a wetland environment with suitable planting to provide pollution reduction and potential habitat for birds and invertebrates. Attenuation SUDS will generally take the form of aesthetic curvilinear drainage features in accordance with current best practice guidance DMRB HA103/06.

5.8.8. In line with the Highland Council's Flood Risk and Drainage Impact: Supplementary Guidance (The Highland Council, 2013)[Ref 5-1], Attenuation SUDS proposals will contribute to controlling discharge rates to existing runoff rates and volumes for design storms up to the 200 year Return Period.

5.8.9. Attenuation SUDS have been positioned outwith the mapping extents of SEPA's medium flood risk zones where possible. The extents of these zones will be subject to further verification in the Stage 3 assessment, and allowances will be considered for compensatory floodplain storage where required.

5.8.10. On larger catchment areas, i.e. where it is possible to implement long-term storage based on minimum practical sized flow controls (SUDS Manual s.3.3.1)[Ref 5-2], Attenuation SUDS proposals aim to contribute to volumetric control by provision of long-term storage using the methods outlined in the SUDS Manual s.3.3.1 (CIRIA C753, 2011).

5.8.11. Opportunities to utilise infiltration drainage in order to contribute to volumetric control and better match existing hydrological patterns, will be reviewed during detailed design, following a more in depth geotechnical assessment of the groundwater regime and groundwater sensitivity.

5.8.12. Surface water runoff arising from side roads will be subject to a minimum of one level of treatment and developed in line SEPA's regulatory guidance WAT-RM-08 [Ref 5-3] where appropriate.

Watercourse Crossings

5.8.13. The proposed widening options are located within the catchment and associated sub-catchments of the River Spey. Within the study area there are several major tributaries of the River Spey, including the River Dulnain, the River Feshie and the River Druie.

River Spey

5.8.14. The River Spey is the third longest river in Scotland, rising in the Corrieyairack Forest (south west of Newtonmore) at 350m AOD and flowing northeast to the Moray Firth. The river lies to the east of the A9 throughout the scheme extents, and runs to the east of Aviemore. North of Aviemore, the A9 and the Spey diverge, as the road turns west towards Slochd Summit, and the Spey continues north / north easterly towards the Moray Firth.

River Dulnain (Tributary of River Spey)

5.8.15. The River Dulnain rises in the Monadhliath Mountains. It flows northeast to the west of Kinveachy Forest. The Dulnain is crossed by the A9 at Carrbridge, NGR 2896 8225, Ch.16,950. The Dulnain is crossed by the Highland Mainline railway immediately to the east of the A9 alignment. The confluence of the Dulnain with the Spey is at the village of Dulnain Bridge, NGR 3004 8237, outwith the area considered by the scheme.

5.8.16. At the A9 crossing, both northbound and southbound widening options are viable. It is assumed that the existing structure will be retained, and that a new parallel structure will be built to carry the new carriageway. Residential properties are located in close proximity to this structure, with the southbound widening option noted to have a direct impact to outbuildings and land associated with the property 2 Broom Cottages. To the southbound side of the A9, the river follows a northward curve, so that southbound widening would require a slightly longer central span than a new structure to the northbound side. To the north of the bridge, any widening to the southbound side would result in the new carriageway on the bridge approach being placed in the narrow corridor between the A9 and the Highland Mainline Railway. To the south of the bridge, widening to the northbound side would result in the new carriageway on the northbound approach conflicting with a telecommunications mast.

Allt nan Ceatharnach (Tributary of River Dulnain)

5.8.17. Allt nan Ceatharnach is formed by the confluence of the Allt a'Bhainne and the Allt Ruighe Magaig in the Baddengorm woods to the north of the A9. Allt nan Ceatharnach is crossed by the A9 at NGR 2891 8231, Ch. 17,800, by a structure known as Baddengorm Bridge. Allt nan Ceatharnach flows into the River Dulnain approximately 300m west of the River Dulnain Bridge.

5.8.18. Baddengorm Bridge has large perpendicular wingwalls. For either northbound or southbound widening, at least 2 of these wingwalls will require demolition as well as the associated embankment works. As any replacement structure would have to be constructed in two halves in order to maintain an open carriageway during the works, further analysis will be undertaken during Stage 3 to determine whether the existing deck can be retained.

5.8.19. The current structure is in an area of undeveloped woodland, with no settlements in the vicinity. Both northbound widening and southbound widening have been assessed to have similar impacts on the surroundings, and both options are equally feasible.

5.8.20. Aside from the aforementioned tributaries of the River Spey, the following watercourses all have an impact on the A9, as they are crossed by the A9 within the scheme boundaries. These are examined from south to north, excluding those described above.

Allt Chriochaidh

5.8.21. Allt Chriochaidh rises on the south eastern face of Geal-charn Mòr at a height of 740m AOD. Allt Chriochaidh is crossed by the A9 at NGR 2856 8095, Ch. 960. Allt Chriochaidh outfalls into the western end of Loch Alvie. The A9 follows the north shore of Loch Alvie.

5.8.22. It is currently proposed to retain the existing structure to carry one carriageway and construct a new parallel structure to carry the new carriageway. Both northbound widening and southbound widening have been assessed to have similar impacts on the surroundings, and both options are equally feasible.

Allt na Chriche (Tributary of River Spey)

5.8.23. Allt na Chriche rises on the south eastern face of Geal-charn Beag (as Allt Dubh) and flows past Lynwilg Farm before being crossed by the A9, B9152 and the Highland Mainline in close succession. The A9 is crossing is at NGR 2883 8106, Ch.3910. The outfall into the River Spey is at NGR 2884 8104. (NB: not to be confused with Allt na Criche, to the north of Aviemore)

5.8.24. It is currently proposed to retain the existing structure to carry one carriageway and construct a new parallel structure to carry the new carriageway. It is likely that widening to the southbound side will result in earthworks supporting the bridge approach conflicting with the existing B9152 alignment to south of the structure. There are no constraints immediately to the north of the structure, however approximately 200m further north, northbound widening would conflict with the access track to Lynwilg Farm. It should be noted that the three junction layout options for Aviemore South each contain a spur which could connect to an access for Lynwilg Farm and Lynwilg Farm Cottages.

Steallan Dubh (Tributary of Aviemore Burn)

5.8.25. Steallan Dubh rises at an altitude of 570m AOD on Carn Dearg Mòr and flows east through Craigellachie Nature Reserve. Steallan Dubh is crossed by the A9 immediately west of Aviemore at NGR 2893 8138, Ch 7,550. Steallan Dubh merges with Milton Burn to form Aviemore Burn, which flows parallel to the A9 in a southerly direction, and outfalls into the Spey at NGR 2898 8124.

5.8.26. The existing crossing of Steallan Dubh is a buried corrugated pipe. It is proposed that this is demolished, and replaced by a concrete portal frame structure. Although the corridor is constrained on either side, it should be possible to proceed with either northbound or southbound widening without impacting on adjacent properties. The watercourse crosses the A9 perpendicularly, and so the required span will be unaffected by either a northbound or southbound widening option.

Allt na Criche

5.8.27. Allt na Criche rises between Càrn Mòr and An Leth-chreag in the Monadhliath Mountains northwest of Aviemore. Allt na Criche is crossed by the A9 at NGR 2900 8156, Ch. 9,520. Allt na Criche outfalls into Loch nan Carraigean, which appears not to have an outfall into any watercourse, although it may drain through the boggy ground between Loch nan Carraigean and the River Spey. (NB: not to be confused with Allt na Chriche, to the south of Aviemore)

5.8.28. The existing Allt na Criche crossing is a buried corrugated pipe. It is proposed that this is demolished and replaced with a concrete portal frame structure which the supports the dual carriageway. Both northbound widening and southbound widening have been assessed to have similar impacts on the surroundings, and both options are equally feasible.

Fèith Mhòr (Tributary of River Dulnain)

5.8.29. Fèith Mhòr rises in Kinveachy Forest to the west of the A9. Fèith Mhòr is crossed by the A9 at NGR 2907 8207, Ch. 14,830. The Highland Mainline crosses Fèith Mhòr to the east of the A9. The confluence of the Dulnain and the Fèith Mhòr is at NGR 2942 8240, outwith the area considered in this study.

5.8.30. The existing Fèith Mhòr crossing is a buried corrugated pipe. It is proposed that this is demolished and replaced with a concrete portal frame structure which the supports the dual carriageway. Both northbound widening and southbound widening have been assessed to have similar impacts on the surroundings, and both options are equally feasible.

5.8.31. As most of the watercourses in the scheme corridor run roughly perpendicular to the road alignment, all road alignment options will require new or replacement structures in similar locations to the existing. It will not be possible to remove the need for a watercourse crossing by selecting one road alignment option over another.

Watercourse Diversions

5.8.32. A preliminary hydromorphology assessment has been undertaken and is included in Part 6, Appendix 10.1, and summarised in Part 3, Chapter 10 Road Drainage and the Water Environment. Small scale channels such as drainage ditches were screened out of the hydromorphology assessment due to their lack of geomorphological interest/diversity. Approximately 20 watercourses, ranging from small streams to large rivers were identified as having geomorphology interest.

5.8.33. At Stage 2 it has been assumed all new/extended culverts will require minor realignment of watercourses immediately upstream and downstream of the proposed culvert structure. Additionally, four watercourses were identified where major realignment (>10m in length, as defined by SEPA) may be required. These realignments would be required for both northbound and southbound widening, with the exception of the realignment of the Allt Cnapach (near Kinveachy Lodge) which would be required for northbound widening only. Further details are provided in Part 3, Chapter 10 and Part 6, Appendix 10.1.

5.8.34. Watercourse diversions are anticipated in order to minimise the number of culverted crossings for small-scale channels, such as drainage ditches. At appropriate locations, these are likely to be realigned to run alongside the proposed scheme and aggregated together before transfer below via culverts. Flood risk implications from potential cross catchment transfers and conflicts with the road drainage network will be considered during DMRB Stage 3. It is anticipated that these issues can be designed out at Stage 3.

Flooding

5.8.35. A Flood Risk Assessment (FRA) has been undertaken and is included in Part 6, Appendix 10.2, and summarised in Part 3, Chapter 10 Road Drainage and the Water Environment.

5.8.36. The DMRB Stage 2 FRA assesses the flood risk from all sources, and includes detailed river modelling to confirm the existing watercourse crossing capacities and the extents of the functional floodplains.

5.8.37. The DMRB Stage 2 FRA identified that the Proposed Scheme would have an overall Large/Very Large significance to the existing fluvial flood risk locally and to downstream receptors, as a result of increasing culvert capacity and the displacement and or loss of floodplain volume.

5.8.38. Where the proposed scheme was identified to have an impact on flood risk, mitigation measures would be required to offset the impact. It is anticipated that these issues, can be addressed at Stage 3 and the residual risk confirmed.

5.8.39. The hydraulic models will be used to inform the design of all watercourse crossing and discharges into the receiving watercourses. In accordance with the regulatory guidance and design standards. Consultation with SEPA will be an ongoing process with regards to flood risk.

Summary

5.8.40. An initial assessment of the existing road drainage and watercourse features has been carried out for each mainline and junction option. This will be reviewed and developed further during the DMRB Stage 3 assessment for the Preferred Route.

5.8.41. As a consequence of the similarity of the mainline options and junction layouts there is very little to differentiate the options for road drainage and watercourse crossings at this stage of the project. The mainline options are all a consistent length and adopt a similar overall footprint, therefore all options are considered to be equivalent in terms of drainage provision.

5.8.42. Junction layouts which are based on a smaller landtake, such as the cloverleafs, are considered to be marginally more favourable as the road drainage network would be reduced in size with potential for smaller SUDS facilities.

5.8.43. In terms of watercourse crossings, all options are considered to be equally affected by existing watercourses. The majority of structures carrying watercourses have been identified as requiring complete replacement due to the existing structural condition which is nearing the end of its design life and not readily refurbished or modified. Alternatively where possible and where the road geometry allows, an existing structure can be retained and a new structure formed up or downstream to pass under the new section of carriageway. Nevertheless it is noted that regardless of the structural solution promoted, there are no key differentiating factors which have been identified between the options.

Scope of Stage 3 Assessment

5.8.44. The DMRB Stage 3 assessment will include for a more detailed consideration of the drainage network for both the trunk road and side road networks and include consultation with SEPA and The Highland Council and other key stakeholders as appropriate as outlined in Part 3, Chapter 10.

5.8.45. Additional information will be collated to supplement the baseline data collected during the current phase of the assessment in order to provide more robust data for developing the specimen design covering the mainline and junctions.

5.8.46. Cumulative and indirect impacts will be considered as part of the Stage 3 assessment and fed into the design approach.

5.9. Geotechnics and Earthworks

Comparison of Options

5.9.1. A summary of the issues affecting the proposed mainline options are presented in Tables 2.5.1 through to 2.7.1, with discussion on the junctions presented in tables 2.8.1 through to 2.10.1. Further identification and discussion of the issues are presented in the Geotechnical Risk Register in Appendix 5.1.

5.9.2. Detailed information supporting the summaries below is shown in the following figures. Note junction assessment is included within the relevant mainline options. It should be noted that the assessments have been undertaken in advance of scheme specific ground investigations. Further ground investigations are proposed in support of Stage 3 assessments.

Mainline Option 1

- Figures 5.19: Geological Plan and Long Section
- Figures 5.22: Superficial Geology
- Figures 5.25: Solid Geology
- Figures 5.28: Geotechnical Constraints and Hazards

Mainline Option 1A

- Figures 5.20 Geological Plan and Long Section
- Figures 5.23: Superficial Geology
- Figures 5.26: Solid Geology
- Figures 5.29: Geotechnical Constraints and Hazards

Mainline Option 2

- Figures 5.21 Geological Plan and Long Section
- Figures 5.24: Superficial Geology
- Figures 5.27: Solid Geology
- Figures 5.30: Geotechnical Constraints and Hazards

5.10. Discussion

Geotechnical Engineering Risks and Mitigation

5.10.1. A summary of the identified risks and potential engineering mitigation measures are discussed in the following section, with further identification and discussion presented in the Geotechnical Risk Register included in Appendix 5.1.

5.10.2. With the exception of advance peat probing investigation, scheme specific ground investigations had not been undertaken at the time of writing. Assessments have therefore been based upon available published information and review historical ground investigation data.

5.10.3. Additionally, at the time of writing a selection of assessments in connection with scheme development were ongoing and will be included as part of the Stage 3 assessments. A summary of the omissions are summarised below. As a consequence of the omission, the impacts have not been considered within the assessment and shall be undertaken as part of the Stage 3 assessments.

- Inspection and assessment of existing earthwork assets in accordance with HD41/15

- Inspection and assessment of existing rock cutting assets in accordance with SRNLS method
- Assessment of impact and risk posed by hazards beyond the proposed construction footprint including but not limited to:

    - Debris flow
    - Slope instabilities - Landslides
    - Peat slides
    - Rockfall

Earthwork Design and Construction

5.10.4. It should be noted that for clarity in detailing earthworks design and construction, the mainline has been broken down and described in discrete sections. Therefore unless otherwise stated, the issues identified apply consistently across all mainline and junction options relevant to the section.

5.10.5. Anticipated materials are conjectured largely to comprise dense and very dense Fluvioglacial and Glacial sands and gravels with high cobble and boulder content. The conjectured materials are unlikely to restrict the proposed junction earthwork design of nominal 1V:3H slopes. Mainline earthwork slopes will vary to allow for embedded mitigation for landscaping and it is not anticipated that this will be restricted by the conjectured materials. However, appropriately sized plant shall need to be sourced to ensure excavation is achieved.

5.10.6. The exception to this assumption is where the earthworks are to be formed within existing peat deposits. For such occurrences over excavation and replacement with a suitable engineered fill, relaxation of the cutting slopes to a 1V:5H across the thickness of peat and / or inclusion of a sludge lock below embankments may be required to ensure long term performance.

5.10.7. Where available, historical boreholes indicate a high groundwater table. Appropriate drainage measures will be required to control groundwater flows within earthworks and temporary control measures may be required for excavations. However, it is noted that the existing A9 alignment will have impacted on the existing groundwater regime since the undertaking of the boreholes with the associated existing A9 drainage having a natural draw down of the water table.

5.10.8. Locally, excavation and replacement of peat (Sections 1, 4, 5, 7, 8, 9, 11 and all junctions) or compressible alluvial deposits (Sections 1, 7, 8, 9, Aviemore South and Granish) may be required to assist with construction of embankments, long term stability of slopes and mitigation of potential excessive settlements. It should be noted that the aforementioned Sections represent where unsuitable conditions are thought to be present. However, further occurrences may occur. Where anticipated material thickness makes excavation and replacement uneconomical, consideration could be given to soil reinforcement (geogrids), lime stabilisation, the use of lightweight fill, vibro-ground improvement or a piled foundation solution. Assessment of such requirements will form part of the Stage 3 assessment following completion of the ground investigations.

5.10.9. It is anticipated that Made Ground associated with the existing A9 will have been placed in a controlled manner. However, in the absence of records this cannot be confirmed. Made Ground represents an inherently variable material which may require pre-treatment (e.g. dynamic compaction) or excavation and replacement to mitigate risks to the final construction.

5.10.10. Further Made Ground deposits associated with previous site activities, such as infilled quarries (Sections 1, 3a, 4, 5, 10, Aviemore South and Granish Junction) and borrow pits (Section 3a) are also anticipated. Details on the backfilled composition and method of placement are unavailable raising the risk of inherently variable material which may require pre-treatment (e.g. dynamic compaction) or excavation and replacement with suitable engineer fill.

5.10.11. Locally, the proposed earthworks (Sections 1, 3a, 4, 7 and 8) are shown to be within the potential extents of a 1:200 year flood event. Such events have the potential to induce instability or degradation of the earthworks. Scour protection measures such as the placement of rock fill within affected areas should be considered.

5.10.12. Option 2, Section 3a, as proposed illustrate earthworks as being constructed over Loch Puladdern. Further instances of earthworks being constructed over waterbodies are required at Sections 6a and 6b. To facilitate construction, placement of 6A fill material, dewatering / diversion of the waterbody or construction of a retaining structure would be required. Similarly Granish Junction impacts up the Allt na Criche which will require treatment or realignment of the watercourse.

5.10.13. It is noted that the works are to be undertaken within the Slochd GCR Section 11 which may impact on any geotechnical solution. Discussions over the impact to the GCR are covered within Part 3 – Environmental Assessment.

5.10.14. Within Section 11 the proposed earthworks are required to be constructed over a significant natural depression at Slochd Mòr. Noting the potential difficulties associated with the construction of earthworks across the depression, consideration should be given at Stage 3 to the use of alternative options such as a permanent structure (e.g. viaduct). Currently, a 23m high, 400m long retaining wall has been allowed for in the cost estimates and the opportunities register records the potential cost reduction if a sidelong viaduct is used. It is also noted that the adjoining slope of Carn nam Bain-tighearna is exhibiting signs of instability which could impact on the proposed A9. Stabilisation and / or protection measures should be considered. The existing Slochd Mhuic culvert will have to be considered within the selected option.

5.10.15. At the time of writing inspection of existing earthwork assets along the A9 remained ongoing. This shall be concluded as part of Stage 3 assessments. Where local instabilities are recorded re-design or corrective measures will be required.

Rock Cutting Design and Construction

5.10.16. It should be noted that for clarity in detailing rock cutting design and construction, the mainline has been broken down and described in discrete sections. Therefore unless otherwise stated, the issues identified apply consistently across all mainline and junction options relevant to the section.

5.10.17. Rock cuttings are anticipated within Sections 3a, 3b, 6a, 6b, 7, 9, 10 and 11. It is anticipated that the cutting shall be achievable by means of conventional ripping. However, programme and surrounding environs may necessitate the need for blasting.

5.10.18. Similarly, shallow bedrock is anticipated within Sections 3a, 3b, 6a, 6b, 7, 9, 10 and 11. It is anticipated that the excavation of the rock shall be achievable by means of conventional ripping. However, programme and surrounding environs may necessitate the need for blasting.

5.10.19. Beyond the proposed site boundaries, instability manifesting as localised rockfalls or debris flows may be present. This risk is particularly prevalent in Sections 3a, 3b, 6a, 6b, 7, 9, 10 and 11. Protective measures such as traps or netting may be required to protect the A9.

5.10.20. At the time of writing inspection of existing rock cut assets along the A9 remained ongoing. This shall be concluded as part of Stage 3 assessments. Where local instabilities are recorded re-design or corrective measures will be required.

5.10.21. Rock cuttings shall be designed and constructed to provide safe and sustainable rock slopes, minimising instability and the requirement for future maintenance and minimising environmental impact. It is intended that the design and construction of rock excavation works shall minimise the requirement for the provision of any permanent means of rock control or containment, such as rockfall netting, rock catch fences and barriers either on the rock face or verge, and the use of strengthening or support (rock dowels or bolts), concrete buttresses, shotcrete and the like. However, ongoing stability and protection of the public shall take precedence for temporary control and permanent long term performance. The rock slopes shall include for the formation of the appropriately designed drainage ditches and rock trap ditches with rockhead berms formed at the contact between sound rock and overlying materials be broken before excavation.

Structure Design and Construction

5.10.22. Anticipated ground conditions are likely to favour the use of traditional foundations for mainline overbridges, underpasses and culverts. For larger structures, such as Slochd Beag and River Dulnain or others which may impose increased loadings, a piled foundation solution will likely be required. The anticipated high cobble and boulder content, may restrict the advance of driven or sheet piles.

5.10.23. Anecdotal evidence suggests that the founding conditions for the Slochd Beag structure shall comprise highly weathered rock which may require pre-treatment to form a competent formation. Treatment may include consolidation grouting.

5.10.24. The high groundwater table is likely to require the adoption of appropriate drainage measures to control groundwater flows within excavations. Appropriate scour protection is to be allowed for during the Stage 3 design of structures.

5.10.25. Buried concrete should allow for the adequate design against chemical attack and degradation.

Interaction with Existing Infrastructure and Properties

5.10.26. Section 3a of Option 1 and 1A currently shows interaction with the B9152 and other existing infrastructure. This would require a geotechnical solutions such as retaining walls or reinforced earth to achieve construction.

5.10.27. Further interaction with existing infrastructure is on Option 2 at Ch4600 where the proposed embankment encroaches onto a residential property. A retained solution will be required for Option 2 at this location. On the opposite side, Option 1 encroaches on the B9152 as it approaches Aviemore. To a lesser degree, Option 1A encroaches on both.

5.10.28. North of Granish, the Highland Mainline runs to the east of the existing A9 alignment. The earthworks for the southbound options, 1 and 1A encroach on the railway embankment. It is therefore considered that an engineered solution such as a retaining structures would avoid this interface.

Excavated Material Acceptability

5.10.29. With the exception of local access roads and junction access roads, cuttings generally coincide with existing cuttings along the A9 which are to be re-profiled to facilitate the widening of the existing A9 route. The cuttings are typically within areas of predominantly granular materials of Glaciofluvial origin and areas of shallow bedrock based on the available desk study information. It estimated that approximately 80% of the materials shall be suitable for re-use.

5.10.30. Total acceptability can only be confirmed by a ground investigation planned to be carried out during the DMRB Stage 3 assessment once a preferred option has been selected.

Unacceptable Material and Contaminated Land

5.10.31. Excavated unacceptable materials which cannot be used in the main earthworks construction could include but are not limited to Made Ground, topsoil, peat and soft clays and silts (e.g. alluvium). Such deposits would require to be:

- Remediated for re-use e.g. soil mixing or lime stabilisation;
- Reused elsewhere on site in the form of landscaping (where suitable); or
- Disposed of off-site.

5.10.32. Where materials are deemed unsuitable as a bearing formation material, the impact on excavated volumes can be minimised through the use of various in situ ground improvement techniques, particularly on the soft non-organic soils. Such treatments or options include but are not limited to:

- Excavation and replacement with suitable excess material sourced from site;
- Lime stabilisation;
- Soil mixing;
- Vibro-stone columns;
- Use of imported lightweight fills;
- Soil reinforcement – e.g. geogrids; or
- Piling.

The above options may not be fully suitable for suspected peat deposits which are expected to be encountered across the scheme. Such deposits are likely to require full excavation and replacement.

Cut/fill Balance

5.10.33. Approximate earthworks volumes have been estimated to allow a reasonable comparison between route options. An overview of the estimated cut/fill balance is presented in Tables 5.10.1 and 5.10.2, with further discussion in Table 18.4 of Chapter 18. As noted above, it has been estimated that approximately 80% of the materials shall be suitable for re-use.

5.10.34. In terms of earthworks balance, estimated bulk volumes show that all mainline options are generally well balanced based on the preliminary road alignment and earthworks design. Overall, mainline options 1 and 1a have less requirement for cut, with option 2 marginally more favourable in terms of the total overall earthworks balance. It is however noted that as part of the Stage 3 assessment, a more detailed mass haul evaluation will be undertaken taking into account the full 25km project length which will include the identification of mass haul constraints, such as major structures, and the associated constructability issues.

5.10.35. The cut/fill balance will be refined and optimised following ground investigation and further earthworks design development for the preferred alignment option.

Table 5.10.1: Mainline alignment Cut / Fill Balance overview

Description	Units	Quantity / Volume
Option 1		
Cut Volume	Cu. M	1,747,537
Fill Volume	Cu. M	-2,046,510
Topsoil Volume	Cu. M	0.00
Cut / Fill difference	Cu. M	-298,973
Option 2		
Cut Volume	Cu. M	2,428,365
Fill Volume	Cu. M	-2,220,345
Topsoil Volume	Cu. M	0.00
Cut / Fill difference	Cu. M	208,020
Option 1A		
Cut Volume	Cu. M	1,760,421
Fill Volume	Cu. M	-2,088,029
Topsoil Volume	Cu. M	0.00
Cut / Fill difference	Cu. M	-327,608

Table 5.10.2: Junction Option Cut / Fill Balance overview

Description	Units	Quantity / Volume					
		Aviemore South					
		A02		A09		A18	
Cut Volume	Cu. M	58,874		43,240		64,929	
Fill Volume	Cu. M	-162,346		-396,046		-217,904	
Topsoil Volume	Cu. M	0.00		0.00		0.00	
Cut / Fill difference	Cu. M	-103,472		-352,806		-152,975	
		Granish Junction					
		C18	C21	C31		C34	
Cut Volume	Cu. M	166,595	184,014	247,868		157,359	
Fill Volume	Cu. M	-21,232	-22,316	-116,815		-73,539	
Topsoil Volume	Cu. M	0.00	0.00	0.00		0.00	
Cut / Fill difference	Cu. M	145,363	161,698	131,053		83,820	
		Black Mount Junction					
		D02	D03	D07	D12	D13	D51
Cut Volume	Cu. M	41,945	29,650	116,219	34,576	40,828	154,268
Fill Volume	Cu. M	-128,390	-98,977	-56,947	-175,060	-72,558	-103,745
Topsoil Volume	Cu. M	0.00	0.00	0.00	0.00	0.00	0.00
Cut / Fill difference	Cu. M	-86,445	-69,327	59,272	-140,484	-31,730	50,523

Summary

5.10.36. A summary of the preferred mainline alignment and junction options, taking due consideration of the geotechnical constraints discussed above is presented in Tables 5.10.3 and 5.10.4.

5.10.37. Overall it is noted that there is no significant differentials with the mainline options, with Options 1 and 1a marginally more favourable as they are considered to have less impact on rock cuttings.

5.10.38. In terms of the junction layouts, there are no differentiating factors which have been identified between layout options.

Table 5.10.3: Most Favourable Mainline Alignment Widening Options Based On Geotechnical Assessment

Section	Chainages and Description	Recommended Mainline Alignment Widening				
		Option 1	**Option 2**	**Option 1A**	**No differential**	**Comment**
1	CH0 – 2500m Kincraig-Dalraddy tie-in to northern-most extent of Loch Alvie	-	-	-	✓	Option 2 is at a slightly higher risk due to closer proximity to former quarry. However, risk is considered marginal.
2	CH2500 – 3500m Northernmost extent of Loch Alvie to Allt na Criche watercourse **(Includes Aviemore South Junction)**	-	-	-	✓	Identified risks consistent across all options.
3a	CH3500 – 5500m Allt na Criche to north of Loch Puladdern	-	-	✓	-	Option 1 brings the alignment closer to existing infrastructure and the B9152 which would require either demolition, diversion, or solutions such as retaining measures. Option 2 requires interaction with existing rock slope which could increase the risk of instabilities and require extensive works. Option 2 also requires interaction with Loch Puladdern which again will require extra over works.
3b	CH 5500 – 6700m North of Loch Puladdern to northern extent of Craigellachie NNR	✓	-	✓	-	Option 2 requires interaction with existing rock slope which could increase the risk of instabilities and require extensive works.
4	CH6700 – 7900m Northern extent of Craigellachie NNR to Granish Farm	✓	-	✓	-	Option 2 requires interaction with existing rock slope which could increase the risk of instabilities and require extensive works.

Section	Chainages and Description	Recommended Mainline Alignment Widening				
		Option 1	**Option 2**	**Option 1A**	**No differential**	**Comment**
5	CH7900 – 10400m Granish Farm to Avielochan **(Includes Granish Junction)**	-	-	-	✓	With exception of former quarry impacting Option 1 the identified risks consistent across all options
6a	CH10400 – 11700m Avielochan to south of Kinveachy	✓	-	✓	-	Option 2 requires interaction with existing rock slope which could increase the risk of instabilities and require extensive works.
6b	CH11700 – 13000m South of Kinveachy to north of Knock of Kinveachy	-	-	-	✓	Identified risks consistent across all options
7	CH13000 – 16300m North of Knock of Kinveachy to Carrbridge	✓	-	✓	-	Option 2 requires interaction with existing rock slope which could increase the risk of instabilities and require extensive works.
8	CH16300 – 17600m Carrbridge to Baddengorm Woods	-	-	-	✓	Identified risks consistent across all options
9	CH17600 – 20900m Baddengorm Woods to east of An Slochd Beag **(Includes Black Mount Junction)**	-	-	-	✓	Identified risks consistent across all options
10	CH20900 – 23100m East of An Slochd Beag to south of Slochd summit	-	-	-	✓	Identified risks consistent across all options
11	CH23100 – 25030m South of Slochd summit to tie-in with existing dual carriageway north of Slochd	-	-	-	✓	Identified risks consistent across all options

Table 5.10.4: Most Favourable Junction Option Based On Geotechnical Assessment

Mainline Option	Junction	**Most Favourable Option**	**Comment**
1	Aviemore South Options A02 or A09	No Differential	-
2	Aviemore South Options A02, A09 or A18	No Differential	-
1A	Aviemore South Options A02, A09 or A18	No Differential	-
1	Granish Options C31 or C34	No Differential	-
2	Granish Options C18 or C21	No Differential	-
1A	Granish Options C31, C34	No Differential	-
1	Black Mount Options D03, D12, D51	No Differential	Consider removal of option D12 and D51 on account of larger footprint requiring increased excavation of peat deposits.
2	Black Mount Options D02, D07, D13	No Differential	-
1A	Black Mount Options D03, D12, D51	No Differential	Consider removal of option D12 and D51 on account of larger footprint requiring increased excavation of peat deposits.

Scope of Stage 3 Assessment

5.10.39. During Stage 3, further ground investigations are anticipated to be undertaken to inform the development of the specimen design.

5.10.40. The issues considered at Stage 3 include:

- Development of the earthworks design, particularly with regards to reviewing opportunities to slacken or steepen side slopes.
- Investigate construction techniques for sections of the project located in peat
- Determine rock assets and develop design for rock cuts and protection measures where appropriate.
- Review ground conditions affecting structures and assess foundation options.
- Review acceptability of excavated material.
- Review options of treatment for unacceptable material and contaminated land.

5.11. Structures

Introduction

5.11.1. This section sets out the requirements for structures throughout the scheme. This will be developed further for the preferred option at Stage 3. The geometrical alignments of the three mainline options, 1, 1A and 2 result in a variation of the earthworks requirements, and so each will result in a variation on the structure dimensions for most of the existing and new structures within the scheme. The main exceptions are the new bridge required at Slochd Beag, where the northbound widening option was sifted out due to the impacts on ancient woodland, the non-motorised user route NCN7 and adjacent private properties, as well as the fewer engineering challenges due to topography and the railway interface that southbound widening presented.

5.11.2. At this stage, the structure locations required are the same for each mainline option. However, the different junction layout options will result in structure geometry variations, in addition to the range of structural form options that will be brought forward for Stage 3 analysis for each junction structure.

5.11.3. At present, all the structure proposals described in the following paragraphs comply with the DMRB, however departures from standard may be required at Stage 3 in relation to some of the proposed structures as the scheme design develops. Only outline details are provided at this stage, further details will be developed in the DMRB Stage 3 assessment following identification of the preferred mainline alignment option.

5.11.4. The proposed options are based on the adoption of concrete construction where span lengths allow, either cast in-situ or precast, as this is generally the most cost efficient and lowest maintenance type of construction. Steel concrete composite construction is assumed at locations where larger spans cannot be avoided.

5.11.5. Integral construction has been assumed where the overall length of the structure does not exceed 60m and the skew does not exceed 30 degrees. This is to minimise long term maintenance requirements and costs. Where integral construction cannot be achieved, bearings and movement joints are assumed, including where bearings are required, it is assumed abutment inspection galleries will be featured in the design to allow for future inspection and maintenance.

5.11.6. The proposed structure locations are shown on Figure 2.3 in Volume 2.

New Structures Required

5.11.7. As most of the obstacles requiring bridges run perpendicular to the route, it will not be possible to remove the requirement for a structure by selecting one mainline road alignment over another. New structures will be required at every significant obstacle, as none of the existing structures are suitable for a dual carriageway. Each structure location has been assessed individually: in some locations the new structure will support a single carriageway and be constructed parallel to the existing; in other cases, the existing structure will be demolished in its entirety and a new dual carriageway structure shall be built in its place.

5.11.8. The retaining walls required will vary between mainline options, as a result of the different earthworks footprint resulting in different retained solutions to avoid encroachment.

Culverts and underpasses

5.11.9. The existing culverts mostly comprise a buried corrugated pipe structure which is difficult to maintain and inspect. It is proposed that these should all be replaced with reinforced concrete portal frame structures. Mammal ledges are also proposed in accordance with SEPA's "Engineering in the water environment: good practice guide" [Reference 5-4] where suitable. Wing walls provided at each end of the culvert may consist of either precast or cast in-situ reinforced concrete, some may be faced in stone to fit in with surroundings. An example of the proposed culvert design is shown on Figure 5.33.1 in (Volume 2). Below is a list of the existing culverts on the Dalraddy to Slochd Section:

Table 5.11.1: List of existing culverts in the Dalraddy to Slochd scheme.

Existing Culverts (South to North)	
• A9 1100 C70 Caochan Burn • A9 1110 C10 Ballinluig Burn • A9 1120 C19 Lynwilg Farm • A9 1130 C54 Kinakyle • A9 1150 C7 • A9 1150 C49 • A9 1150 C25 • A9 1150 C87 Milton Sheep Creep • A9 1150 C95 Steallan Dubh • A9 1150 C11 • A9 1170 C4 Granish • A9 1170 C6 Shunem • A9 1170 C12 Allt Na Criche • A9 1170 C18 Avielochan 1 • A9 1170 C20 Avielochan 2	• A9 1170 C22 Avielochan 3 • A9 1170 C23 Avielochan 4 • A9 1170 C26 Avielochan 5 • A9 1170 C32 Laggantygowan Creep • Unknown Culvert 2 • A9 1170 C53 Kinveachy Kennels • A9 1170 C75 Feith Mhor • A9 1170 C77 Crannaich 1 • A9 1170 C81 Crannaich 2 • Unknown Culvert North of Slochd Beag • A9 1210 C31 Slochd Mhuic • A9 1210 C39 Slochd Mor 1 • A9 1210 C45 Slochd Mor 2 • A9 1210 C46 Slochd Mor 3

5.11.10. Pre-cast portal frame units are currently preferred to cast insitu structures for constructability purposes. It is proposed that these are constructed offline adjacent to the existing carriageway, and backfilled as part of the embankment works for the new carriageway. Once the new carriageway is complete, it is proposed that the existing carriageway is shut, and the existing culvert is demolished and replaced, before the new structure is backfilled and the road reopened as a dual carriageway. Careful planning could reduce disruption by undertaking the works on a number of culverts and underpasses in the same area simultaneously, reducing the duration of carriageway closures and the number of crossovers required.

5.11.11. It is assumed at this stage that all existing buried corrugated pipe underpasses are to be replaced, rather than extended beneath the new carriageway. Similar to the culverts, these will be replaced with a portal frame structure. The methodology proposed for the replacement of the existing buried corrugated pipe culverts outlined in 5.11.10 is also proposed for the replacement of the existing underpasses.

5.11.12. Slochd Mhuic culvert is a culvert at Ch. 23,350 where the watercourse in the Slochd Mòr depression is culverted from the southbound side of the carriageway to northbound side. The culvert is formed of pre-cast concrete units, and is located 22m below the road surface of the existing A9. Replacement of this culvert presents severe constructability difficulties due to the depth of the existing structure. In addition, the local topography restricts access and the site is a noted geotechnical hazard due to the risk of rock fall from the slopes of Carn nam Bain-tighearna above Slochd Mòr. A jacked box structure would be difficult to install as a replacement due to the hard rock and the lack of working room at either end of the culvert. To guarantee the lifetime of the structure, an insitu concrete lining system could be utilised, although this would require careful hydrological review to ensure that the subsequent reduction in culvert capacity did not affect the hydrological system.

5.11.13. The current Slochd Mhuic culvert does not permit easy inspection and it is likely that the solution adopted would require remote inspection in future.

Options for Underpass Form of Construction

5.11.14. Pre-cast Integral Concrete Box - Pre-cast units require less labour to manufacture, and may be produced to a higher finish quality than insitu alternatives. Economies of scale may be achieved if a standardised pre-cast unit can be determined upon prior to construction. However, installing many pre-cast box units will require large volumes of lifting plant throughout the scheme, and transporting large pre-cast units to site may prove difficult. An alternative would be to use pre-cast portal frames. If necessary, these can be brought to site as broken down units and tied together using an insitu reinforced concrete stitch.

5.11.15. Cast insitu Integral Concrete Underpass - A cast insitu unit will be quicker to procure, will not require as much cranage, and will potentially be more durable due to the reduced number of joints. However, it will be more labour intensive, and the remote nature of the sites may present difficulties for concrete supply and transport. Additionally, as the time for the concrete to gain strength must be allowed for, this may slow progress and have programme implications.

Junction Structures

5.11.16. New structures are required at Aviemore South, Granish and Black Mount junctions. During the sifting process, which reviewed the effects of topography, geological conditions, constructability concerns and structures at each junction, as well as the impacts on the utilities and surrounding environment, it was determined that Aviemore South and Black Mount junctions will require overbridges, whilst an underbridge will be required at Granish junction.

5.11.17. The final form of the structures has not yet been determined. The structural forms brought forward for assessment are discussed for each junction location below.

5.11.18. For ease of construction, all the overbridge options brought forward are of the beam and slab form. Some options have already been sifted out, for example, it has been determined that full height abutments shall be avoided to retain an open aspect to each structure, and that piers in the central reservation are to be avoided as they present a hazard in the event of a collision to both vehicle occupants, and potentially to the integrity of the structure itself.

5.11.19. Pre-cast pre-stressed concrete beams also allow for a potential constructability advantage if beams with wide bottom flanges are placed adjacent to each other, immediately creating a continuous soffit to work from upon installation, rather than requiring the installation of permanent formwork between the beams before there is sufficient working space on the deck.

5.11.20. Steel girders present the advantage that they may be manufactured in smaller, more easily transportable sections, prior to splicing on site, whilst a concrete beam must be delivered as the full length of the span. Steel girders will require a greater maintenance input over the lifespan of the structure, including renewal of the protective coating system, unless weathering steel is used. Weathering steel is allowed to oxidise to a dull reddish-brown colour, which may lead to this option being rejected on architectural and aesthetic grounds.

5.11.21. The junction structures are shown in the following figures:-

- Aviemore South - Figure 5.34
- Aviemore South layout A18 - Figure 5.35
- Granish - Figure 5.36
- Black Mount - Figure 5.37

Each junction structure type is shown over an example junction layout in order to demonstrate a potential form the junction structure may take. Aviemore South layout A18 is treated separately, as the structural solution required for this option is unique to this junction layout option.

Aviemore South

5.11.22. Underbridge options were sifted out for Aviemore South, as the A9 alignment would have to be raised significantly to achieve the required headroom. This would require a much greater volume of earthworks increasing the footprint of the junction, impacting on adjacent properties. Structure options 1 and 2, which have square spans apply to junction layouts A02 and A09, whilst structure option 3 applies solely to junction layout option A18, as the realignment of the B9152 and altering priorities at the junction requires the side road to cross the A9 at a high skew.

Table 5.11.2: Aviemore South Junction Structure Options

Structure Options		Applicable Junction Layouts	Commentary
1	Insitu concrete slab on single span precast concrete beams supported on half height abutments	A02 A09	• Half height abutments are preferred at this stage to retain an open aspect to the structures. • Potential constructability issues with this option, as the beams must be transportable to site. Steel girders with splices are an alternative to allow a single span.
2	Insitu concrete slab on three span precast concrete beams supported on bankseat abutments and piers either side of the carriageway	A02 A09	• Piers and columns in the central reservation present a hazard which would exacerbate the effect of any collision • As the central span is shorter, there exists an opportunity to reduce construction depth, lower the road and potentially reduce land take and fill required.
3	Skewed bridge comprising Insitu concrete slab on three span steel plate girders supported on bankseat abutments and piers either side of the carriageway	A18	• This options is based on junction layout option A18 to provide a smoother and free flow alignment between the A9 and B9152. • This junction layout has the largest overall footprint. • The bridge will be required to be supported on bearings due to the skew and the length of span • The greater span required will result in a greater construction depth. To maintain headroom, the road levels will need raised over the structure which will have an impact on the landtake and volume of earthworks required. • Both plate girders and box girders present a viable option. Box girders would reduce construction depth, but contain hidden elements in a confined space which require inspection.

It should be noted that the above discussion refers to the structural aspects of Aviemore South junction. The final layout option selection will be based on inputs from the full range of relevant disciplines.

Granish

5.11.23. Overbridge options were sifted out for Granish, as the A95 is currently lower than the A9 and so it would be impossible for the A95 geometry to comply with design standards for vertical geometry if raised to the required level for an overbridge.

Table 5.11.3: Granish Junction Structure Options

Structure Options		Applicable Junction Layouts	Commentary
1	Cast insitu reinforced concrete portal frame	C18 C21 C31 C34	• This option will take the longest to construct. • This option does not allow for much offline construction, resulting in longer periods of road closures.
2	Pre-cast beams supporting cast insitu slab	C18 C21 C31 C34	• This option requires a large amount of online construction, for the insitu abutments and insitu deck. • This option allows for prestressed beams to reduce the construction depth.
3	Pre-cast portal frame underpass	C18 C21 C31 C34	• The underpass has a larger profile than the other underpass structures on the project, and will probably be too big to transport to site as complete units, requiring insitu stitches to be cast on site.

5.11.24. As with the replacement culverts and underpasses, it is proposed that the Granish underpass is constructed in two halves in order to allow one carriageway to remain open to traffic at all times. Once the first half is completed, bidirectional traffic would be switched to the new carriageway to allow demolition of the existing embankment, and construction of the new underpass. This could be undertaken simultaneously with underpass works in the vicinity of northern Aviemore to reduce disruption.

Black Mount

5.11.25. Underbridge options were sifted out for Black Mount, as the A9 alignment would have to be raised approximately 8m to achieve the required headroom. This would require a much greater volume of fill and a larger junction footprint. 6 No. junction layout options are considered at Black Mount, 3 No. for northbound widening, and 3 No. for southbound widening. One junction layout for each widening option is a restricted movement junction, only allowing southbound vehicles to exit the carriageway and only allowing northbound vehicles to enter the carriageway.

Table 5.11.4: Black Mount Junction Structure Options

Structure Options		Applicable Junction Layouts	Commentary
1	Insitu concrete slab on single span precast concrete beams supported on half height abutments	D02 D03 D07 D12 D13 D51	• Half height abutments are preferred at this stage to retain an open aspect to the structures. • Potential constructability issues with this option, as the beams must be transportable to site. Steel girders with splices are an alternative to allow a single span.
2	Insitu concrete slab on three span precast concrete beams supported on bankseat abutments and piers either side of the carriageway	D02 D03 D07 D12 D13 D51	• There exists an opportunity to reduce construction depth, lower the road and potentially reduce land take and fill required. • For junction layouts D07 and D51, it is likely that the slip roads for the half cloverleaf loops would have to run under the first and third spans.

5.11.26. It should be noted that the above discussion refers to the structural aspects of Black Mount junction. The final layout option selection will be based on inputs from the full range of relevant disciplines.

5.11.27. Layouts D07 and D51, both of which are half cloverleaf junctions with the loops in quadrants two and four will require longer structures. This would require a greater construction depth for single span options, raising the overbridge road surface to maintain headroom. If the beams or girders in the single span option are haunched, the structure may require further lengthening for the loop layout options to move the haunched portion beyond the side roads to maintain headroom.

Watercourse Crossings

5.11.28. It is assumed that the existing structures will remain in place for watercourse crossings and will be converted to uni-directional running, whilst a new parallel structure is constructed for the opposite uni-directional carriageway.

5.11.29. The constraints applied by the watercourses and the impacts from northbound or southbound widening on the structures are examined in Section 5.8.13.

5.11.30. Other than Dulnain (see below), watercourse crossings will be integral reinforced concrete portal frames. The deck may be either a cast insitu slab on insitu abutments, a pre-cast slab on cast insitu abutments, pre-cast, pre-stressed beams tied together with insitu concrete or a pre-cast portal frame. The existing watercourse crossing bridges are at Allt Chriochaidh, Criche, Dulnain and Baddengorm. For culverted watercourse crossings, refer to 5.11.9.

5.11.31. The structures listed below are the key structures, each of which will have a bespoke solution to be developed during Stage 3. This list does not include culverts or underpasses, as it is currently proposed to replace these structures with a generic or standardised design.

Table 5.11.5: Key and Bespoke Structures

Structure Name	Scheme Chainage (m)	Description
Allt Chriochaidh	960	Existing single span reinforced concrete box. New structure to parallel existing.
Criche	3,910	Existing single span reinforced concrete portal frame. New structure to parallel existing.
Carrbridge Underpass	16,920	Existing single span reinforced concrete portal frame. New dual-carriageway structure to replace existing.
Dulnain	16,950	Three span structure comprising steel girders and cast insitu concrete slab. New structure to parallel existing.
Baddengorm	17,800	Existing single span reinforced concrete portal frame. New dual-carriageway structure to replace existing.
Slochd Beag	22,100	Three span structure comprising steel girders and cast insitu concrete slab. New structure to parallel existing.
Slochd Mòr	23,600	Slochd Mòr is not an existing structure, but widening at this location will require an engineered solution

Carrbridge Underpass

5.11.32. At Carrbridge, both northbound and southbound widening encroach on neighbouring properties. Southbound widening offers greater possibilities for mitigation measures to be applied, as neighbouring properties are within the footprint of the earthworks required but not the road itself. A retaining wall at this location, potentially as an extension to a parallel wingwall on the southbound side would reduce the footprint of the new road.

5.11.33. The most recent principal inspection on the structure was undertaken in 2011, and indicated that concrete repairs at a number of locations would be required.

5.11.34. It is proposed that the existing structure is demolished and a new structure would be built with the capacity to carry the new dual carriageway over the existing access to Carrbridge. The new structure would match the existing span of 8.1m and be 26.3m in width. The alternative option of a new structure carrying a single carriageway adjacent to the existing one would result in the dual carriageway having a larger footprint than an entirely new structure carrying both carriageways, with the attendant increase in impacts to the surroundings. An example of the proposed underpass design is shown on Figure 5.32 in (Volume 2).

5.11.35. Constructing a new dual carriageway structure within the footprint of the Carrbridge underpass would result most likely a two stage 2 process to allow the A9 to remain open, i.e. construction of half a new structure to allow traffic to be diverted on this to allow demolition of the existing structure and subsequent completion of the new structure.

Dulnain

5.11.36. Carrbridge Underpass is directly adjacent to the south abutment of Dulnain Bridge, hence works at Dulnain are under the same constraints as at Carrbridge. Both northbound and southbound widening encroach on neighbouring properties. Southbound widening offers greater possibilities for mitigation measures to be applied, as neighbouring properties are within the footprint of the earthworks required, but not the road itself.

5.11.37. As a tributary of the River Spey, the River Dulnain is within the River Spey Special Area of Conservation (SAC). To avoid encroachment into the SAC, the bridge piers shall be placed outwith the watercourse and beyond the limits of the SAC.

5.11.38. The most recent principal inspection on the existing structure was undertaken in 2011. The inspection recommended that repairs to steelwork, concrete piers and abutments and bearings were undertaken, in addition to periodic maintenance such as clearing the drainage troughs. Following a review of the inspection reports, a deck or structure replacement is not deemed necessary.

5.11.39. Various structure design options have been considered and sifted out, including demolition of the existing structure with full replacement by a dual carriageway structure. Pre-cast concrete beams for the new structure were sifted out as the spans are too great, and the new structure would lose aesthetic similarity with the existing. Similarly, pre-cast segments constructed using a balanced cantilever method were also sifted out as the new structural form would be markedly different from the existing.

5.11.40. It is currently proposed to retain the existing structure and construct a new parallel structure of similar design. This 3 span structure will accommodate the new southbound carriageway for Options 1 and 1A, and the northbound carriageway for Option 2. It will be a steel composite bridge with steel I-section or box girders and reinforced concrete (RC) deck. The intermediate supports will comprise reinforced concrete 'T' profile columns on spread footings and the end supports will comprise reinforced concrete bank seat abutments on spread footings (south) or piled foundations (north). The new bridge will have an overall approximate length of 82m and be 14.3m in width. An example of the underbridge is shown in Figure 5.32 (Volume 2).

Baddengorm

5.11.41. Several design options have been considered for this mainline option including demolishing the existing structure and building a new structure to carry both carriageways. It is currently proposed to demolish the existing structure and replace it with a new integral structure supporting a dual carriageway.

5.11.42. The existing structure is in reasonable condition, and the most recent General Inspection from 2012 recommends only minor concrete repairs to the structure, and more extensive repairs to the parapet connections. Due to the wingwalls of the existing structure running parallel to the watercourse and the height of the embankments, extensive demolition would be required prior to any new construction, even if the existing structure were to be retained.

5.11.43. In order to reduce disruption to A9 users, it may be possible to construct the deck slab offline, and crane it into position. The area surrounding Baddengorm bridge is mostly wooded and boggy, although there is open, flat ground to the east and a larger area to the south, which may be suitable as a landing and preparation area, although both are screened from the site of the bridge by woodland.

5.11.44. Due to the remote location, it is assumed that temporary haul roads will be required to facilitate access as the watercourse level is situated approximately 10m below carriageway levels. An existing track to the structure extends from Dalrachney Beag, although as this track currently fords the Allt an Ceatharnach, a temporary bridge may be required. An existing track approaches from the north, however this track stops short of the bridge, and an extension through woodland would be required.

5.11.45. An example of the proposed new underbridge structure is shown in Figure 5.32 (Volume 2).

Slochd Beag

5.11.46. The existing bridge at Slochd Beag carries the existing A9 over the Highland Mainline Railway and the old A9 alignment. The old A9 alignment is now an access route to the settlement at Slochd and part of NCN7. This route is accessed from the existing junction at Black Mount. The old A9 alignment crosses the Highland Mainline railway to the north of Slochd Beag underbridge, and then turns south to cross under the main span of Slochd Beag, parallel to the railway. The old A9 Slochd Beag bridge has been assessed as being in poor condition, and a deck replacement has been recommended. Although this is a Highland Council asset, the requirement for works on this structure has been recorded in the risk register.

5.11.47. Preliminary investigations indicate that the existing Slochd Beag Bridge will be unable to accommodate H4a parapet units. Further consultation will be undertaken with Transport Scotland and Network Rail regarding the provision of parapets on the existing Slochd Beag Bridge during the Stage 3 works. Entry No. 28 for the scheme risk register (refer to A9P11-AMJ-GEN-X_ZZZZZ_XX-MD-MG-0003), records the risk to the project that this structure may require replaced.

5.11.48. The new Slochd Beag bridge will be the largest new structure on the scheme, and will cross the Highland Mainline railway and the old alignment of the A9.

5.11.49. Northbound widening has been sifted out at Slochd Beag due to impacts on the Highland Mainline railway, impacts on the settlement at Slochd and impacts on NCN7.

5.11.50. All 6 of the options for Slochd Beag are for a new structure to the east of the existing Slochd Beag structure. It is proposed for the new structure to take a broadly similar form to the existing one: steel plate girders with a cast insitu concrete deck. Steel box sections could be used, although they would alter the visible form of the new bridge in comparison with the old one.

5.11.51. The spans involved are too large for pre-cast concrete beams to be used, except for Option 5, discussed below. A potential form of concrete construction would be to use pre-cast sections in balanced cantilever construction, although this would result in the two parallel structures looking markedly different from one another.

5.11.52. The options for Slochd Beag are shown in Figure 5.38.

Option 1

5.11.53. Option 1 comprises a new bridge parallel to the existing structure and with the same span arrangement and appearance. Option 1 is constrained by the location of the existing local road which provides access to the settlement at Slochd and forms part of the NCN7 non-motorised user route, which runs parallel to the existing structure within the footprint of the proposed new structure to the east of the Highland Mainline railway.

Option 2

5.11.54. The Slochd Beag underbridge carrying the A9 does not vary from Option 1 to Option 2, however, Option 2 allows for a diversion of the old A9 alignment to the north east, to remove it from the footprint of the new structure. This will require a new railway crossing for the old A9 alignment. The diversion alignment proposed in Option 2 has the diversion crossing the Highland Mainline railway at a very high skew, which would result in a large structure, with large dead areas either side of the carriageway. This option would maintain NCN7 and the Slochd Beag access at their existing width, and the reduced curvature of the new alignment would allow for an easier route for cyclists and drivers.

Option 2A

5.11.55. Option 2A follows the same principle as Option 2, however a greater curvature has been introduced into the diversion alignment, reducing the skew of the structure and hence reducing the size of the structure. This option will require less materials than 2A and will be cheaper and quicker to build. Given the low speed of the road the greater curvature for Option 2A over Option 2 should not present any issues for traffic using the road.

Option 3

5.11.56. As with Option 2 and Option 2A, Option 3 proposes the same new structure for Slochd Beag as Option 1, and provides a new diversionary route for the Slochd settlement access. The diversion alignment is to the south west of the A9. As with Option 2, the new diversion alignment crosses the Highland Mainline railway at a high skew, resulting in a large structure with large dead areas either side. It is likely that this new alignment would require new rock cuts and new embankments to the south of the A9.

Option 4

5.11.57. Option 4 proposes a goalpost arrangement for the pier of the new Slochd Beag structure allowing it to straddle the old A9 alignment. This arrangement would result in less impact to the railway during construction in comparison to Options 2, 2A and 3, and would have reduced impacts to the Slochd Beag access in comparison to Option 1. The structure would be aesthetically different from the existing, but this would only be perceivable from certain angles. As the access to the settlement at Slochd is along the existing route, consideration would have to be given to a deck replacement of the old A9 bridge where it crosses the Highland Mainline railway.

Option 5

5.11.58. Option 5 proposes a two-span arrangement, as opposed to the three-span arrangement utilised in other options, with the single pier straddling the old A9 alignment similar to the eastern pier in Option 4. This structure would be smaller than the others and would not resemble the existing in structural form. The shorter spans would allow the use of pre-cast concrete beams, which would reduce costs. Shorter and fewer spans would speed construction, and reduce the amount of working at height and lifting operations that would be required during the works. Large earthworks would be required on the approach to the western abutment, where the western 3rd span sits for Options 1 to 5.

Slochd Mòr

5.11.59. To the north of Slochd Beag bridge, at Slochd Mòr (Ch.23,400 to 23,800), the existing carriageway runs in a constrained corridor. To the west is the Highland Mainline railway, the non-motorised user route NCN7 and Tòrr Mòr, a large hill, whilst to the east a deep, steep-sided valley is present on the southbound side.

5.11.60. At the foot of the valley to the east is a watercourse which flows in a steep, straight, reinforced concrete channel. This channel sits within the footprint of the proposed southbound carriageway for 200m at its northern end. The inlet to this channel is from a culvert under the A9. This channel will require either diversion, or culverting under the new carriageway. Both possibilities present challenges. Diversion would be difficult and would potentially require large volumes of infill to the valley. Culverting would not affect the watercourse, but would result in a confined space which would be difficult to inspect and maintain.

5.11.61. Widening to the northbound side would require a large rock cut through Tòrr Mòr, in addition to the carriageway footprint conflicting with the railway and NCN7. Widening to the southbound side will result in the footprint of the carriageway encroaching into the steep sided valley and will require some form of engineered solution in the form of either a retaining structure or a sidelong bridge structure. Widening to the northbound side was sifted out as part of the Mainline Sifting Workshop due to the impacts on ancient woodland, potential conflicts with the Highland Mainline railway and adjacent properties, impacts on NCN7 and the requirement for southbound widening at Slochd Beag bridge.

5.11.62. Thus far, a preferred solution is yet to be identified, noting that constructing earthworks across the depression at Slochd Mòr would be very difficult. If a retaining wall was to be used, the retaining wall will be approximately 25m high at its highest section and approximately 400m long; this was the option allowed for in the current cost estimates.

Slochd Mòr Retained Options

5.11.63. 3 No. retained options have been considered; 1) reinforced concrete cantilever retaining wall on pad foundation; 2) reinforced concrete cantilever retaining wall on piled foundation; 3) reinforced soil wall

5.11.64. The retained solution has a constructability disbenefit, as it would require working at the foot of the steep sided valley, which has been identified as a geotechnical hazard due to unstable rock in the scree slopes above the valley.

5.11.65. A retained solution will require a much greater volume of fill; the existing steep slope would make access for vehicles, plant and staff into the area to be filled very difficult. An access track may need to be provided. The infilled section is also likely to conflict with the headwall of the Slochd Mhuic culvert, requiring an extension to the culvert. The culvert would require assessment to ensure it could withstand the increased surcharge from the backfill.

5.11.66. A full ground investigation has not yet taken place at the site, but peat probing suggests that peat is present in this region, and therefore a piled foundation is preferred at this stage.

5.11.67. An opportunity has been recorded on the risks and opportunities register to reduce the cost of the engineered solution by supporting the southbound carriageway on a viaduct instead of retained earth. This will have a major cost saving due to the much reduced volume of material required, and may have programme benefits as well.

Refer to Figure 5.40 for the Slochd Mòr Retained Options GAs.

Slochd Mòr Bridge Structure Options

5.11.68. 3 No. bridge structure options have been considered: 1) longitudinally spanning reinforced concrete deck with piers at close centres; 2) transversely spanning reinforced concrete deck with longitudinally spanning downstand beams supported on piers at moderate centres; 3) longitudinally spanning composite reinforced concrete deck with haunched steel girders.

5.11.69. Constructing a sidelong viaduct at this location presents a number of challenges. The steep slopes would make access very difficult for vehicles, plant and staff. An access track may need to be provided.

5.11.70. Foundations would be necessary within the steep slope, which could require deep excavations on one side; foundations would also be difficult to backfill due to the slope and accessibility issues. The sidelong viaduct solution has the advantage that beams could potentially be craned in from the existing carriageway. Options 2) and 3) have the longest longitudinal spans, and hence the least amount of work on foundations within the steep slopes.

5.11.71. The sidelong viaduct will have less impact on the watercourse in the valley, and selection of this option could reduce the length of culvert or diversion required.

5.11.72. A sidelong viaduct option would require more maintenance due to inclusion of bearings, and potentially coating systems as well. A viaduct structure could incorporate inspection galleries to aid inspection and maintenance regimes.

5.11.73. Calculations undertaken to inform the Value for Money Workshop suggest that the viaduct option is cheaper, largely due to the much smaller volume of backfill required, whilst the retained option still requires significant structural works. All six options present significant challenges for constructability, due to the topography and remote nature of the site. Due to the lack of diversionary routes available at Slochd Mòr, it is important that the existing carriageway is kept open as much as possible during the works.

5.11.74. Refer to Figure 5.39 for the Slochd Mòr Structure Options GAs.

Vehicle Containment and Pedestrian Restraint over Structures

5.11.75. Vehicle containment and pedestrian restraint over structures will be designed and installed in accordance with Chapter 4 of TD 19/06 of the DMRB. In general, parapets will be 1.0m high and Normal Containment Level (N2).

5.11.76. Where the structure carries a cycleway, the parapet would be 1.4m in height. The height of the parapet would increase to 1.8m where the structure carries a bridleway or other route accessible to horse riders.

5.11.77. Where new structures cross a railway line, containment will be Very High Containment Level (H4a) parapets 1.8m high in line with TD19/06. These parapets will be of metal or concrete construction. The concrete parapets would be of either in-situ or precast construction.

5.11.78. There is currently one existing structure over the railway within this section at Slochd Beag. Initial consultations have taken place with Network Rail with respect to the potential limitations of the current bridge deck. No specific decisions have been made with respect to proposals for parapets and will be considered in greater detail and through ongoing consultation with Network Rail.

5.11.79. At all locations, suitable transitions and connections will be made between parapets and vehicle restraint systems on the approach and departure ends to each structure in accordance with Chapter 6 of TD 19/06 of the DMRB.

5.11.80. In conjunction with underpasses and culverts provision, pedestrian restraint systems will be installed at the top of headwalls and wing walls in accordance with Chapter 9 of TD 19/06 of the DMRB.

Retaining Walls

5.11.81. Tables 5.11.6 to 5.11.8 show the retaining walls required for each mainline option:

Table 5.11.6: Option 1 - Mainline Retaining Walls

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
S/B	4,750	270	5.0	6.0	The earthworks on the S/B side of the carriageway encroach on the B9152. The retaining wall proposed reduces the footprint of the earthworks and mitigates the obstruction issue. A retaining wall at this location would reduce disruption to the B9152 during the works. An alternative possibility would be to realign the B9152 to the east of the proposed A9 embankment, removing the need for the retaining wall. This proposal would cause disruption to the B9152 during realignment.
S/B	5,300	193	3.3	5.1	The earthworks on the S/B side of the carriageway encroach on a core path and a pond. An alternative possibility would be to realign the core path and landscape the pond away from the embankment footprint. Realigning the path would cause disruption to the users of the path during construction. Consideration would have to be given to environmental and ecological impacts on the pond during landscaping works. Alternatively, the core path could be realigned locally where the embankment encroaches on the route and a retaining wall with a reduced length of 38.5m and uniform height of 5.1m could be constructed at the section where the embankment conflicts with the pond. This possibility removes the requirement to landscape the pond and lowers the height of the retaining wall. There would be disruption to the users of the core path during construction.
S/B	5,900	270	4.3	7.3	The earthworks on the S/B side of the carriageway encroach on commercial and residential properties.
S/B	7,260	350	7.5	15.5	The earthworks on the S/B side of the carriageway encroach on a core path. An alternative possibility would be to realign the core path. This would eliminate the requirement for the retaining wall. Realigning the core path may cause some disruption during the works.
S/B	9,640	180	3.7	5.5	The embankment encroaches on a section of the historic General Wade's Military Road. The retaining wall is required to be as close to the carriageway as possible, however, section of the military road at the southern end is within the footprint of the retaining wall. It should be noted that this retaining wall will only be required if Option C34, half dumbbell and trumpet is selected for Granish Junction.

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
S/B	10,200	250	7.0	9.0	The earthworks on the S/B side of the carriageway encroach on adjacent properties. At Ch.10250 the embankment splays out to a width of 86m and encroaches on a track and a field. To avoid this track the resulting retaining wall height (1 in 3 slope) would be 28.5m. Alternatively, the slope of the embankment could be reduced, broadening the embankment and allowing the field over which the embankment is proposed to be built to return to its existing usage.
S/B	12,050	250	8.5	11.2	The earthworks on the S/B side of the carriageway encroach on the railway line and a side road. As the earthworks only encroach on the railway embankment by maximum 3.5m it may be possible to alter the slope of the embankment to avoid contact. This possibility does not mitigate the conflict with the side road. The side road will be further addressed as part of the Tier 2/3 accesses assessment during Stage 3.
S/B	13,620	190	0.8	0.9	The earthworks on the S/B side of the carriageway encroach on the railway line. The retaining wall would remain close to the Network Rail boundary, as close as 0.5m in places.
S/B	16,570	40	3.8	4.0	The earthworks on the S/B side of the carriageway encroach on a property. It may be possible to construct this retaining wall as continuation of, and infill between, the abutment wingwalls of Carrbridge Underpass and Dulnain Bridge.
N/B	23,750	320	2.0	3.3	The cutting on the N/B side of the carriageway encroaches on the non-motorised user route NCN7. An alternative possibility would be to realign the cycle path. This would remove the requirement for the retaining wall. The footprint of the embankment would be of a larger size than when retaining walls are in place and there would be disruption during realignment to the users. The realignment may also cause inconvenience to some users.

Option 1: Total retaining wall length: **2313m**
Mean retaining wall height: **4.59m**

Table 5.11.7: Option 1A - Mainline Retaining Walls

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
N/B	4,630	90	1.8	2.2	The earthworks on the N/B side of the carriageway encroach on a property.
S/B	4,750	270	5.0	6.0	The earthworks on the S/B side of the carriageway encroach on the B9152. The retaining wall proposed reduces the footprint of the earthworks and mitigates the obstruction issue. A retaining wall at this location would reduce disruption to the B9152 during the works.
S/B	4,960	75	4.0	6.0	The earthworks on the S/B side of the carriageway encroach on properties. The retaining wall proposed reduces the footprint of the earthworks and mitigates the obstruction issue with the properties. Moreover, there would be no disruption to the property adjacent to the A9. The height of the retaining wall could be reduced roughly to a maximum height of 5m height and an average height of 3m by allowing the embankment to be retained closer to the obstruction. This would be further refined in stage 3 report. Another possibility would be to enter negotiations with the property in question, with the aim of allowing the embankment to be built in full. The property is a site and has no structures obstructing the A9 dualling so there would be no demolition work required.
S/B	5,300	193	3.3	5.1	The earthworks on the S/B side of the carriageway encroach on a core path and a pond. An alternative possibility would be to realign the core path and landscape the pond away from the embankment footprint. Realigning the path would cause disruption to the users of the path during construction. Consideration would have to be given to environmental and ecological impacts on the pond during landscaping works. Alternatively, the core path could be realigned locally where the embankment encroaches on the route and a retaining wall with a reduced length of 38.5m and uniform height of 5.1m could be constructed at the section where the embankment conflicts with the pond. This possibility removes the requirement to landscape the pond and lowers the height of the retaining wall. There would be disruption to the users of the core path during construction.
S/B	5,900	270	4.3	7.3	The earthworks on the S/B side of the carriageway encroach on commercial and residential properties.
S/B	7,260	350	7.5	15.5	The earthworks on the S/B side of the carriageway encroach on a core path.

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
					An alternative possibility would be to realign the core path. This would eliminate the requirement for the retaining wall. Realigning the core path may cause some disruption during the works.
S/B	9,640	180	3.7	5.53	The earthworks on the S/B side of the carriageway encroach on adjacent properties. At Ch.10250 the embankment splays out to a width of 86m and encroaches on a track and a field. To avoid this track the resulting retaining wall height (1 in 3 slope) would be 28.5m. Alternatively, the slope of the embankment could be reduced, broadening the embankment and allowing the field over which the embankment is proposed to be built to return to its existing usage.
S/B	10,200	250	7.0	17.5	The earthworks on the S/B side of the carriageway encroach on the railway line and a side road. As the earthworks only encroach on the railway embankment by maximum 3.5m it may be possible to alter the slope of the embankment to avoid contact. This possibility does not mitigate the conflict with the side road. The side road will be further addressed as part of the Tier 2/3 accesses assessment during Stage 3.
S/B	12,050	250	8.5	11.2	The earthworks on the S/B side of the carriageway encroach on the railway line. The retaining wall would remain close to the Network Rail boundary, as close as 0.5m in places.
S/B	13,620	190	0.8	0.9	The earthworks on the S/B side of the carriageway encroach on a property. It may be possible to construct this retaining wall as continuation of, and infill between, the abutment wingwalls of Carrbridge Underpass and Dulnain Bridge.
S/B	16,570	40	3.8	4.0	The cutting on the N/B side of the carriageway encroaches on the non-motorised user route NCN7. An alternative possibility would be to realign the cycle path. This would remove the requirement for the retaining wall. The footprint of the embankment would be of a larger size than when retaining walls are in place and there would be disruption during realignment to the users. The realignment may also cause inconvenience to some users.
N/B	23,600	320	2..0	3.3	The earthworks on the S/B side of the carriageway encroach on commercial and residential properties.

Option 1A: Total retaining wall length: **2478m**
Mean retaining wall height: **4.31m**

Table 5.11.8: Option 2 - Mainline Retaining Walls

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
N/B	4,600	130	1.8	2.2	The earthworks on the N/B side of the carriageway encroach on a property.
S/B	4,730	85	4.0	4.0	The earthworks on the S/B side of the carriageway encroach on the B9152. The retaining wall proposed reduces the footprint of the earthworks and mitigates the obstruction issue. A retaining wall at this location would reduce disruption to the B9152 during the works.
N/B	4,800	210	12.0	22.0	The earthworks of the N/B embankment encroach on the Craigellachie National Nature Reserve and a SSSI. It should be noted that the SSSI designated area runs from Ch. 4800 to Ch. 6680 and large sections of the Option 2 proposed northbound carriageway and embankment encroach this area.
N/B	5,100	350	3.0	12.0	The earthworks of the N/B embankment encroach on the Craigellachie National Nature Reserve and a SSSI. The proposed Option 2 alignment earthworks protrude into Loch Puladdern. The required retaining wall will present constructability issues as construction would be required in close proximity to the loch. It should be noted that the SSSI designated area runs from Ch. 4800 to Ch. 6680 and large sections of the Option 2 proposed northbound carriageway and embankment encroach this area.
N/B	5,800	200	1.0	1.0	The earthworks of then N/B embankment encroach on the Craigellachie National Nature Reserve and a SSSI. It should be noted that the SSSI designated area runs from Ch. 4800 to Ch. 6680 and large sections of the Option 2 proposed northbound carriageway and embankment encroach this area.
S/B	7,260	350	7.5	15.5	The earthworks on the S/B side of the carriageway encroach on a core path. An alternative possibility would be to realign the core path. This would eliminate the requirement for the retaining wall. Realigning the core path may cause some disruption during the works.
N/B	7,430	60	3.0	4.5	The embankment on the N/B side of the carriageway encroach on a SuDS pond. An alternative possibility would be to steepen the slope of the embankment from the currently proposed 1 in 3 slope.
S/B	9,640	180	3.7	5.5	The earthworks on the S/B side of the carriageway encroach on adjacent properties.

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
					At Ch.10250 the embankment splays out to a width of 86m and encroaches on a track and a field. To avoid this track the resulting retaining wall height (1 in 3 slope) would be 28.5m. Alternatively, the slope of the embankment could be reduced, broadening the embankment and allowing the field over which the embankment is proposed to be built to return to its existing usage.
S/B	10,700	50	9.0	9.0	The earthworks of the embankment intrude on a SUDS infiltration pond on the S/B carriageway side. An alternative possibility would be to relocate the pond to the east of its current position.
S/B	12,050	430	6.5	8.0	The earthworks on the S/B side of the carriageway encroach on the railway line and a side road. As the earthworks only encroach on the railway embankment by maximum 3.5m it could be a possibility to alter the slope of the embankment to avoid conflict. This possibility does not resolve the conflict with the side road. The side road will be further addressed as part of the Tier 2/3 accesses assessment during Stage 3.
N/B	22,950	100	3.0	4.0	The cutting on the N/B side of the carriageway encroaches on the non-motorised user route NCN7. An alternative possibility would be to realign the cycle path. This would remove the requirement for the retaining wall. The footprint of the embankment would be of a larger size than when retaining walls are in place and there would be disruption during realignment to the users. The realignment may also cause inconvenience to some users.
N/B	23,225	150	8.0	25.0	The cutting on the N/B side of the carriageway encroaches on the non-motorised user route NCN7. An alternative possibility would be to realign the cycle path. This would remove the requirement for the retaining wall. The footprint of the embankment would be of a larger size than when retaining walls are in place and there would be disruption during realignment to the users. The realignment may also cause inconvenience to some users.
N/B	23,700	350	2.8	3.0	The cutting on the N/B side of the carriageway encroaches on the non-motorised user route NCN7. An alternative possibility would be to realign the cycle path. This would remove the requirement for the retaining wall. The footprint of the embankment would be of a larger size than when retaining walls are in place and there would be

C/way	Chainage (m)	Length (m)	Height Average (m)	Height Max (m)	Note
					disruption during realignment to the users. The realignment may also cause inconvenience to some users.

Option 2: Total retaining wall length: **2645m**
Mean retaining wall height: **5.02m**

5.11.82. Option 1 requires the shortest length of retaining walls, whilst Option 2 requires the longest. The minor variation of 165m between Option 1 and Option 1A is accounted for in the difference between northbound and southbound widening at the foot of Lag na Caillich, where the earthworks for northbound widening encroach upon local residential properties, thereby necessitating a retained solution to be promoted. Option 2 requires a greater length of retaining walls to the northbound side in the vicinity of Aviemore, due to the proximity of the SSSI, which includes the physical constraint of Loch Puladdern.

5.11.83. As noted above, the opportunity exists at several locations along the project extents to reduce the length and height of retaining walls, or even remove them entirely. This shall be further considered at Stage 3.

5.11.84. Aviemore South Junction

Table 5.11. 9: Aviemore South Junction Retaining Walls

Junction Option		**Retaining walls required**
A02	Half cloverleaf; quadrants 1 and 4	There are potential conflicts with tracks on both sides of the route. At this stage, it is believed realignment of the tracks would be a more appropriate solution than providing retaining walls.
A09	Diamond left-right with ghost island	There are potential conflicts with tracks on the southbound side of the route for both the on and off slips. At this particular location it is considered that realignment of the tracks would be a more appropriate solution than providing retaining walls.
A18	Left-right stagger with B9152 realigned	There are potential conflicts with tracks on the southbound side of the route for both the on and off slips. At this stage, it is believed realignment of the tracks would be a more appropriate solution than providing retaining walls.

5.11.85. Granish Junction

Table 5.11.10: Granish Junction Retaining Walls

Carriageway	Junction Option		Retaining walls required
S/B widening	C31	Diamond	A retaining wall would be required at the southbound on-slip to avoid encroachment onto adjacent property.
S/B widening	C34	Half dumbbell and clover leaf	A retaining wall would be required at the southbound on-slip to avoid encroachment onto adjacent property.
N/B widening	C18	Diamond	It is not considered that any retaining walls are required for this option.
N/B widening	C21	Half dumbbell and clover leaf	A retaining wall would be required at the northbound half dumbbell, as there is a watercourse above the level of the road, which is in the area of the proposed rock cut.

The retaining wall required to avoid conflict with the adjacent property is the same length for each southbound widening option, however, for the half dumbbell and clover option, C34, the required retaining wall would be lower in height.

5.11.86. Black Mount Junction

Table 5.11.11: Black Mount Junction Retaining Walls

Carriageway	Junction Option		Retaining walls required
S/B widening	D03	Restricted movements diamond	It is not considered that any retaining walls are required for this junction location.
S/B widening	D12	Diamond with left-right stagger	
S/B widening	D51	Half cloverleaf, quadrants 2 & 4	
N/B widening	D02	Diamond with left-right stagger	
N/B widening	D07	Half cloverleaf, quadrants 2 & 4	
N/B widening	D13	Restricted movements diamond	

Summary

5.11.87. All options include for a significant number of structures including bridges, underpasses and retaining structures. The most significant of these are the three junction bridges, Dulnain Bridge, Baddengorm Bridge, Slochd Beag Bridge and the engineered solution at Slochd Mòr.

5.11.88. Southbound widening at Craigellachie Underpass has fewer impacts upon the Craigellachie NNR and SSSI. Slightly further north, Option 1 or 1A present fewer impacts on constraints at High Burnside and Milton Underpasses due to the presence of residential properties on the northbound side of the carriageway.

5.11.89. Option 2 presents greater complexities at Dulnain Bridge, due to the greater proximity of residential properties on the northbound side. As Dulnain Bridge and Carrbridge Underpass are directly adjacent to one another, Option 2 also presents constructability complexities at Carrbridge Underpass. Option 1 and 1A may then be preferable at Baddengorm as well, due to the short distance between them in which to construct a crossover.

5.11.90. For the other structures, there is little differential in terms of favourable widening option between Options 1, 1A and 2.

5.11.91. Option 2 will require the longest overall length of retaining wall structures, followed by Option 1A and then Option 1. The key difference between Options 1 and 1A is the result of retaining walls provided adjacent to the properties located at Lynwilg and Lag na Cailich. At these locations, Option 1A adopts a hybrid route which avoids properties on either side of the mainline; however the earthworks would encroach onto these properties were it not for the additional retaining walls. The mainline for Option 1 conflicts with the property at Lynwilg, rendering any mitigation moot and removing the requirement for these retaining walls.

5.11.92. The retaining walls required for Option 2 are overall higher, thus resulting in a greater capital cost and increased construction challenges. At Ch.4800, the retaining walls required for Options 1 and 1A are circa 4m high, whilst in comparison the same chainage for Option 2 requires a 12m high retaining wall. Additionally, it is noted that shorter retaining walls allow greater scope of designing out or reduction in size as part of future design refinements. This would include consideration of options involving; earthworks adjustments or the combination of embankments with partial side slopes and low retaining walls on the boundary.

Scope of Stage 3 Assessment

5.11.93. During the Stage 3 assessment, a single option shall be developed for each structure required to be demolished or constructed for the preferred scheme option. The selected option for each structure shall be described in detail in the Stage 3 assessment Report and an Outline Approval in Principle shall be developed for each.

5.11.94. Costs associated with each selected option will be reviewed and updated during Stage 3 to feed into the cost estimates.

5.12. Public Utilities

5.12.1. As outlined in Section 2.3 there are a number of underground and overhead Public Utilities within the extents of the scheme.

5.12.2. As part of the New Roads and Street Works Act (1991) procedures, all Public Utility providers have been contacted and asked to provide details of their services within the area. The locations of all the services are shown on Figure 2.4 in Volume 2.

5.12.3. The details of diversions have not been considered as part of this report, however, an assessment of the likely cost of diversion works has been included within the cost estimate based on C2 returns. A detailed review and cost estimate of diversions will be carried out (once a preferred option has been identified) as part of the Stage 3 assessment.

5.12.4. Consultation has been undertaken with landowners located along the length of the A9 corridor in order to ascertain whether a private water supply is in use or if they are served from the Scottish Water supply network. At present a total of 35 properties served by private water supplies have been identified within 1km of the Proposed Scheme Options and up to 5km downstream. It is noted that all of these properties are located within the River Spey catchment. Information relating to private water supplies has been assessed within Part 3, Chapter 10.

5.12.5. An overview of the impact that each of the three mainline options has on utility apparatus is presented in table 5.12.1. The most significant item of utility apparatus is the trunk Scottish Water main located adjacent to the southbound verge within the vicinity of Aviemore (section 3a, 3b, 4 and 5). This is noted to have the greatest impact on the predominately southbound widening option (Option 1).

5.12.6. An overview of the impact the junction locations and layout options have on utility apparatus is presented in table 5.12.2. There are no key differentiating factors identified between each of the junction layouts, with all layouts considered to have an equivalent level of impact on utilities.

Table 5.12.1: Mainline widening options impact on Utilities.

Section	Impact of Southbound Widening on Utilities (Option 1 & 1a)	Impact of Northbound Widening on Utilities (Option 2)
1	A Scottish and Southern Energy High Voltage overhead cable and a BT overhead cable cross the carriageway perpendicularly at Ch. 2250. A Scottish Water existing water main crosses perpendicularly beneath the carriageway at Ch. 2400.	A Scottish and Southern Energy High Voltage Overhead Cable and a BT Overhead Cable cross the carriageway perpendicularly at Ch. 2250. A Scottish Water existing water main crosses perpendicularly beneath the carriageway at Ch. 2400. A Scottish Water main runs within the proposed northbound widening earthworks for approximately 200m from Ch. 1500 to Ch. 1700. This then re-enters the earthworks footprint from Ch. 2300 to the northern end of

Section	Impact of Southbound Widening on Utilities (Option 1 & 1a)	Impact of Northbound Widening on Utilities (Option 2)
		Section 1 where it continues into Section 2.
2	A Scottish and Southern Energy High Voltage overhead cable crosses the carriageway perpendicularly at Ch. 2850. A Scottish Water main crosses perpendicularly beneath the carriageway at Ch. 3080. Approximately 130m of BT cables are located within the existing southbound road verge between Ch. 3180 and Ch. 3310.	A Scottish and Southern Energy High Voltage overhead cable crosses the carriageway perpendicularly at Ch. 2850. A Scottish Water main crosses perpendicularly beneath the carriageway at Ch. 3080. A Scottish Water main runs in the footprint of the proposed northbound widening earthworks throughout Section 2, 1100m in length, and continues into Section 3a. A Scottish and Southern Energy high voltage overhead power line runs in the footprint of the proposed northbound widening earthworks for 400m from Ch. 2600 to Ch. 3000.
3a	A BT cable is located within the verge of the B9152 side road from Ch. 3800 and would require to be diverted to accommodate the earthworks of the southbound mainline widening for approximately 300m between Ch. 3800 and Ch. 4100. The BT link serving the property at Kinakyle is within the footprint of the A9 for a further 200m. A BT overhead cable crosses the carriageway obliquely at Ch. 4850. The Scottish Water trunk water main which serves Aviemore is located in the existing southbound verge of the A9. This crosses under the proposed southbound carriageway at Ch. 3820 and runs along the B9152 to Aviemore, within the footprint of the A9 earthworks for approximately 180m to Ch. 4100. This water main returns to the footprint of the proposed earthworks for approximately	The Scottish Water main in the northbound verge noted in Sections 1 and 2 continues into Section 3 for 200m. This is anticipated to require a total of up to 1500m length of diversion. A Scottish and Southern Energy low voltage underground cable crosses the carriageway perpendicularly at Ch. 4540, before running in the footprint of the proposed northbound widening earthworks for 170m to Ch. 4710. A BT overhead cable crosses the carriageway obliquely at Ch. 4850.

Section	Impact of Southbound Widening on Utilities (Option 1 & 1a)	Impact of Northbound Widening on Utilities (Option 2)
	170m from Ch. 4700 northwards. A branch off this water main crosses the carriageway perpendicularly at Ch. 4670. In the vicinity of Aviemore, this water main runs within the footprint of the proposed southbound carriageway for 500m from Ch. 5000 to the northern end of Section 3a. A further water main crosses the carriageway perpendicularly at Ch. 5250. A Scottish and Southern Energy low voltage underground cable serving the property at Kinakyle conflicts with the A9 for approximately 30m around Ch. 4300. This cable branches at Ch. 4540; one branch crosses the carriageway obliquely, whilst the other runs along the line of the southbound carriageway for a further 60m.	
3b	The Scottish Water trunk main which serves Aviemore runs parallel to the existing southbound carriageway throughout Section 3b for a length of approximately 1200m. A Scottish Water mains also crosses the carriageway perpendicularly at Ch. 5690, and obliquely between Ch. 5900 and Ch. 6000.	A Scottish Water trunk main extends over a length parallel to the carriageway for approximately 1200m from the start of Section 3b, and continues into Section 4. Scottish Water mains also cross the carriageway perpendicularly at Ch. 5690, and obliquely between Ch. 5900 and Ch. 6000.
4	A Scottish Water trunk main extends over a length parallel to the carriageway for approximately 700m. This is a continuation of the item detailed in Sections 3a and 3b above, requiring an anticipated total diversion length of approximately 2300m. At Milton Underpass, approx. Ch. 7270, water mains and a BT cable pass through the underpass perpendicular to the carriageway.	A Scottish Water trunk main extends over a length parallel to the carriageway for approximately 800m from the start of Section 4. This is a continuation of the item detailed in Sections 3b above, requiring a total diversion length of approximately 2000m. At Milton Underpass, approx. Ch. 7270, water mains and a BT cable pass through the underpass perpendicular to the carriageway.

Section	Impact of Southbound Widening on Utilities (Option 1 & 1a)	Impact of Northbound Widening on Utilities (Option 2)
5	A Scottish Water trunk water main is located in close proximity to the carriageway on this section with branches crossing perpendicularly beneath the A9 at Ch. 8470 and Ch. 9450. A Scottish and Southern Energy high voltage overhead cable is within the earthworks footprint for the northernmost 130m of Section 5.	A Scottish and Southern Energy underground cable is within the footprint of the proposed northbound widening for approximately 100m from Ch. 8330 to Ch. 8430. This cable passes underneath the A9 perpendicularly at Ch. 8430. A Scottish Water trunk water main is located in close proximity to the carriageway on this section with branches crossing perpendicularly beneath the A9 at Ch. 8470 and Ch. 9450.
6a	A Scottish and Southern Energy high voltage overhead cable is within the earthworks footprint for 400m, before crossing the carriageway obliquely at Ch. 10800. A branch of this cable also crosses the A9 perpendicularly at Ch. 11050. A Scottish Water trunk main crosses the carriageway perpendicularly at Ch. 10950.	A Scottish and Southern Energy high voltage cable crosses the carriageway obliquely at Ch. 10800, and runs within the footprint of the proposed northbound widening for 700m. A branch of this cable crosses the A9 perpendicularly at Ch. 11050. A Scottish Water trunk main crosses the carriageway perpendicularly at Ch. 10950 and conflicts with the proposed northbound widening earthworks for a length of approximately 500m from Ch. 11200 to Ch. 11700.
6b	Scottish and Southern Energy overhead cables cross the A9 at Ch. 11750 and Ch. 12590. Scottish Water mains cross the A9 perpendicularly at Ch. 12200 and at Ch. 12480. A BT overhead cable crosses the A9 perpendicularly at Ch. 12400 at Kinveachy Kennels.	Scottish and Southern Energy overhead cables cross the A9 at Ch. 11750 and Ch. 12590. Scottish Water mains cross the A9 perpendicularly at Ch. 12200 and at Ch. 12480. A BT overhead cable crosses the A9 perpendicularly at Ch. 12400 at Kinveachy Kennels.
7	A Scottish and Southern overhead power cable crosses the A9 at Ch. 13580.	A Scottish and Southern overhead power cable crosses the A9 at Ch. 13580. The earthworks extents of the northbound mainline widening option impacts upon a pylon.
8	Scottish and Southern Energy power lines and BT cable networks cross underneath the carriageway at Carrbridge underpass, Ch. 16550.	Scottish and Southern Energy power lines and BT cable networks cross underneath the carriageway at Carrbridge underpass, Ch. 16550.

Section	Impact of Southbound Widening on Utilities (Option 1 & 1a)	Impact of Northbound Widening on Utilities (Option 2)
	A BT overhead power cable crosses perpendicular to the A9 at Ch. 17700.	A BT overhead power cable crosses perpendicular to the A9 at Ch. 17700. A telecommunications mast located in the verge at approximately Ch. 16440 is anticipated to be impacted by the northbound mainline widening option.
9	A SSE overhead high voltage line running parallel to the carriageway within the southbound verge from Ch. 18600 to Ch. 19600 is anticipated to be significantly impacted by the southbound mainline widening option. A diversion of approximately 1000m in length may be required.	Northbound widening is not anticipated to have any impacts on utilities in Section 9.
10	A Scottish and Southern Energy overhead power line crosses the A9 at Ch. 20980. A BT cable is present within the footprint of the proposed southbound widening for 350m from Ch. 22400 to Ch. 22750.	A BT underground cable lies within the footprint of the proposed northbound widening for approximately 340m between Ch. 22380 and Ch. 22720.
11		A BT underground cable runs within the footprint of the proposed northbound widening for approximately 500m between Ch. 23600 and Ch. 24100.

Table 5.12.2: Junction layout options impact on Utilities.

Location	Junction Option	Description	Utility Impact
Aviemore South	A02	Half Cloverleaf (Quadrants 1&4)	Impacts on several utilities running parallel and across the A9 mainline. A Scottish Water main runs parallel to the mainline for 600m through the A02 layout, this water main is anticipated to clash with both the northbound on and off slip roads. Overhead SSE High Voltage cables are present on both sides of the mainline, crossing the mainline at the proposed junction location. This cable also crosses the southbound off-slip and the B9152 spur. Potential diversion lengths are anticipated to be 550m. The above noted utilities have spurs which provide links to the properties at Lynwilg. These are anticipated to be affected and require diversion works to be promoted.
	A09	Diamond Left-Right Stagger	Impact as A02
	A18	Diamond Left-Right Stagger with B9152 Realigned	Impact as A02, with the exception of the following: Overhead SSE High Voltage cables are present on both sides of the mainline, crossing the mainline at the proposed junction location. This cable also crosses the southbound off-slip and the B9152 spur. Potential diversion lengths are anticipated to be 700m.
Granish	C18	Diamond (Northbound)	Direct impact on an Overhead High Voltage cable; potentially 500m diversion required. Underground BT cable crosses the mainline, the northbound off slip and the southbound on slip. Potentially 300m diversion required. Scottish Water main conflicts with northbound on and off slips. Potential diversion length anticipated to be 350m.

Location	Junction Option	Description	Utility Impact
	C21	Half Dumbbell / Clover Leaf (Northbound)	Impact as C18
	C31	Diamond (Southbound)	Impact as C18, with the exception of the following: Scottish Water main located in mainline alignment throughout junction length with an anticipated diversion length of over 700m.
	C34	Half Dumbbell / Clover Leaf (Southbound)	Impact as C31
Black Mount	D02	Diamond Left-Right Stagger (Northbound)	Scottish and Southern Energy overhead cable conflicts with southbound on and off slips. Potential diversion of approximately 500m required. Realigned B9153 approach conflicts with a Scottish and Southern Energy buried cable over a length of 150m. BT cable located in the B9153, which is anticipated to require a 900m diversion when the road is realigned.
	D03	Restricted Movements Diamond (Southbound)	Impact as D02, with the exception of the following: Scottish and Southern Energy overhead cable conflicts with southbound off slip and realigned B9153. Potential diversion of approximately 700m required.
	D07	Half Cloverleaf (Quadrants 2&4) (Northbound)	Impact as D02, with the exception of the following: Scottish and Southern Energy overhead cable conflicts with southbound off slip and realigned B9153. Potential diversion of approximately 700m required.
	D12	Diamond Left-Right Stagger (Southbound)	Impact considered to be equivalent to D02.
	D13	Restricted Movements Diamond (Northbound)	Impact as D02, with the exception of the following:

Location	Junction Option	Description	Utility Impact
			Scottish and Southern Energy overhead cable conflicts with southbound off slip and realigned B9153. Potential diversion of approximately 700m required.
	D51	Half Cloverleaf (Quadrants 2&4) (Southbound)	Impact as D02, with the exception of the following: Scottish and Southern Energy overhead cable conflicts with southbound off slip and realigned B9153. Potential diversion of approximately 800m required.

Summary

5.12.7. Over the scheme extents, utility apparatus is generally most densely located within the proximity of Aviemore with the largest and most significant being the Scottish Water trunk main. This follows the alignment of the A9 adjacent to the southbound verge and would be impacted by mainline options 1 and 1a which consist of predominantly southbound widening. Outwith this specific area, all the mainline options are considered to be equally impacted by utility apparatus across the scheme extents.

5.12.8. All junction layouts are considered to have an equivalent impact on utilities as the landtake and form are generally consistent.

5.12.9. In general it is noted that there is no major or significant items of utility apparatus or assets present within the scheme extents which are considered to have a high cost or programme impact should diversion or protection measures be identified as being necessary.

Scope of Stage 3 Assessment

5.12.10. The DMRB Stage 3 assessment will include for a more detailed assessment of the impact on utility apparatus following the procedures set out in New Roads and Street Works Act 1991 - Diversionary Works. Initially this will involve obtaining a C3 Budget Estimate from each undertaker where apparatus is affected. Thereafter as the project develops in conjunction with the Statutory Process, a C4 Detailed Estimate will be obtained.

5.13. Constructability

5.13.1. The majority of the project due to the nature of the carriageway widening involves online construction. This generally involves maintaining the existing carriageway for traffic operations while constructing a central reserve and second carriageway to run parallel. As work progresses, traffic can then be switched onto the new carriageway and the existing carriageway upgraded and widened as necessary. This method of construction necessitates a continuous traffic management system throughout construction in order to maintain one lane of traffic in each direction.

5.13.2. The alternative of offline construction offers the advantage of not requiring the same level of traffic management as online construction. However as the majority of the project falls with an online corridor these works would be limited to the following elements:

- grade separated junctions;
- accesses;
- SUDS facilities; and
- NMU routes and facilities.

5.13.3. In terms of constructability of the structures associated with the project, a description of potential methodology is included within section 5.11. The majority of structures are located online such as underpasses and culverts and these will require to be formed in phases, with the likelihood that a new parallel structure will be constructed before demolition of the existing.

5.13.4. Retaining walls have been identified as being required at various locations along the mainline and at the grade separated junctions. The exact form of structure has not been fully determined at this stage, but it would be anticipated that these would be constructed in conjunction with the main earthworks phase of works.

5.13.5. For the major structures on the project, such as the bridge crossings at Slochd Beag and River Dulnain where it is potentially viable to retain the existing structure, it would be envisaged that a phased approach would be taken to construction. This would involve the existing structure being used for carrying vehicles during the construction of the new parallel structure, and then traffic swapped to the new structure to allow upgrades and improvements as necessary to the existing structure. Where road closures are required for structural works, where practical and where locations permit, these would be scheduled to incorporate a number of structures into a single closure in order to minimise disruption to A9 users.

5.13.6. The key constructability issues associated with each junction layout are summarised in Table 5.13.1. It is noted that in general the junction layouts with the smaller overall footprint and require fewer quadrants will be more compact and offer advantages in terms of reduced earthworks.

Table 5.13.1: Junction Layout Constructability Issues.

Location	Junction Reference	Description	Constructability Issues
Aviemore South	Junction Layout A02	Half Cloverleaf (Quadrants 1&4)	• Construction in 2No. quadrants
	Junction Layout A09	Diamond Left-Right Stagger	• Construction in 4No. quadrants
	Junction Layout A18	Diamond Left-Right Stagger with B9152 Realigned	• Skewed Structure • Construction in 4No. quadrants • Reconfigured B9152
Granish	Junction Layout C18	Diamond (Northbound)	• Construction in 4No. quadrants
	Junction Layout C21	Half Dumbbell / Clover Leaf (Northbound)	• Construction in 3No. quadrants
	Junction Layout C31	Diamond (Southbound)	• Construction in 4No. quadrants
	Junction Layout C34	Half Dumbbell / Clover Leaf (Southbound)	• Construction in 3No. quadrants
Black Mount *(Note that the A938 & U2400 require to be realigned in all junction options)*	Junction Layout D02	Diamond Left-Right Stagger (Northbound)	• Construction in 4No. quadrants
	Junction Layout D03	Restricted Movements Diamond (Southbound)	• Construction in 2No. quadrants
	Junction Layout D07	Half Cloverleaf (Quadrants 2&4) (Northbound)	• Construction in 2No. quadrants
	Junction Layout D12	Diamond Left-Right Stagger (Southbound)	• Construction in 4No. quadrants
	Junction Layout D13	Restricted Movements Diamond (Northbound)	• Construction in 2No. quadrants
	Junction Layout D51	Half Cloverleaf (Quadrants 2&4) (Southbound)	• Construction in 2No. quadrants

5.13.7. The junction layouts proposed at Aviemore South are all located outwith the extents of the existing junction, where as Granish and Black Mount junctions are located within and directly impacting the existing junction footprints. From a constructability perspective it would advantageous if the existing junction could be retained as operational during the construction period. However as all the layouts are equally impacted it is not considered to be a differentiating factor.

5.13.8. In terms of the traffic volumes recorded on the Dalraddy to Slochd project, these are considered to be low compared to other sections of the A9, with an average flow of 7,600AADT. On this basis, the implementation of traffic management is not anticipated to result in major delays or disruption on the trunk road network. It is however acknowledged that the Aviemore area is subject to significant seasonal variations in traffic volumes as a consequence of leisure and tourism.

Summary

5.13.9. All mainline options for the Dalraddy to Slochd scheme are similar in terms of the constructability challenges with generally similar earthworks balance and ground conditions. The main difference between the options can be based on the frequency in which the proposed new carriageway crosses the existing road network.

5.13.10. Mainline Option 1 does not cross the existing carriageway, whilst Mainline Option 1A has 2 No. crossovers south of Aviemore. As Option 2 is a composite of northbound and southbound widening, 5 No. crossovers are required. It is however considered that in overall terms of the project extents, taking account the length of 25km that the promotion of crossovers is not a significant constructability issue which should be a key influence or differentiator in the identification of the preferred option. The phasing of crossovers and the exact arrangement and layout of traffic management will be investigated and developed as part of the Stage 3 assessment.

5.13.11. Major structures required along the scheme extents are consistent for each mainline option with no differentiating factors as the overall span and form are the same regardless of the widening option.

5.13.12. Minor structures such as culverts and underpasses are equally impacted along the length of the scheme with no key differentiating factors. Retaining walls have been identified for the mainline and junctions and from the initial design development, Option 1 has been identified as requiring the shortest overall length of walls of the mainline options.

Scope of Stage 3 Assessment

5.13.13. The DMRB Stage 3 assessment will include milestones within the programme such as a Constructability Audit which will provide a forum to robustly review constructability issues in advance of proceeding to the publication of draft Orders.

5.14. Operation and Maintenance

5.14.1. Operation and maintenance considerations will not vary greatly between the mainline options as the overall lengths and layout are generally similar. This equally applies for structures, with each mainline option having the same requirement for structures, which includes for bridges, underpasses and culverts. Retaining walls do however vary between mainline options, with Option 2 likely to require more maintenance interventions, due to having the greatest length and height of retaining structures.

5.14.2. Drainage provisions, including SUDS facilities for the mainline would be consistent across all the options and therefore there would be no differentiating factors in terms of operation and maintenance.

5.14.3. The junction layouts which offer shorter lengths of slip roads such as the cloverleaf layouts are more favourable from a maintenance and operations perspective as this reduces the overall carriageway area and also results in shorter lengths of drainage and road restraint systems.

5.14.4. It is noted that with the restricted movement option at Black Mount junction (Options D03 and D13) that there will be operational implications as a result of a reduction in the turning movements which can be undertaken. The proposed junction at Black Mount is approximately 11km north of Granish and 11.5km south of the proposed Tomatin junction. In the event of severe winter weather, which has a high probability being located immediately south of Slochd summit, or as a consequence of major maintenance works or a network incident, the restricted movements junction layout would be considered unfavourable with the potential to have a significant adverse impact of the A9 route operation due to having limited turning options compared to a full movements grade separated junction provision.

Summary

5.14.5. For the mainline options there are minimal factors which are able to differentiate the options with the exception of retaining walls. Option 1 is therefore most favourable as it has the shortest overall length requirement for retained structures.

5.14.6. At the junctions, there is greater element of variation in layouts, with the more compact junction arrangements consisting of loops more favoured for operations and maintenance.

Scope of Stage 3 Assessment

5.14.7. Operation and Maintenance issues will be considered in more detail as part of the DMRB Stage 3 assessment with consultation undertaken with Transport Scotland TRBO and the Trunk Road Operating Company.

5.14.8. Costs associated with the maintenance of the scheme will be reviewed and updated during Stage 3 to feed into the cost estimates.

5.15. Non-Motorised Users

5.15.1. For ease of reference, the term Non-Motorised Users (NMUs) is used to describe pedestrians, cyclists and equestrians.

5.15.2. The effects of the route options on all travellers, including NMUs, are considered in Part 3, Chapter 17 (Effects on All Travellers) of this report where the impacts of the route options are presented.

5.15.3. The following objectives have been set in terms of NMU provision in the PES para.4.13.1 for the scheme:

- There will be no at-grade surface crossing of the dualled A9;
- At grade separated crossings of the dualled A9, NMU routes will be combined where possible;
- Junctions and accommodation works underpasses will be utilised, where possible, to provide these crossing points; and
- Over or under road (grade separated) crossing points solely for NMUs may be proposed where site specific consideration can be demonstrated.

5.15.4. NMU routes and impacts on NMU users were considered as part of the mainline and junction sifting evaluations which informed the Stage 2 designs being assessed. In order to meet the objectives for NMUs and address the impacts identified in Part 3, Chapter 17 (Effect on All Travellers) of this report, NMU improvements will be considered during design development of the preferred option during DMRB Stage 3.

5.15.5. Furthermore, the A9 Access Strategy which was developed by Transport Scotland at the outset of the A9 dualling project will be followed during Stage 3 to ensure an inclusive design and approach aimed at creating environments that can be used by everyone regardless of age or disability.

Summary

5.15.6. The most notable NMU route within the study area is NCN 7. All options will have very similar technical requirements for accommodating this and other routes as outlined in Part 3. Therefore there are no differentiating factors which have been identified between the options.

Scope of Stage 3 Assessment

5.15.7. The DMRB Stage 3 assessment will include for the development of NMU routes which are affected by the mainline and junction layout options. This will be undertaken in conjunction with the development of junction layouts and accesses in order to utilise where feasible shared use facilities.

5.15.8. Consultation will be ongoing with key stakeholders such as The Highland Council, Sustrans, Scotways, local NMU groups and landowners to identify any additional or new information that becomes available and seek feedback on proposed options.

5.16. Engineering Assessment Summary

5.16.1. An overview of the Engineering Assessment is provided in Table 5.16.1 for the mainline routes options 1, 1a and 2 and in Tables 5.16.2 to 5.16.4 for the 13No. junction layout options at Aviemore South, Granish and Black Mount.

5.16.2. For the purposes of the overview, the following key has been applied to provide clarity on which options offer a more or less favourable option across the engineering assessment constraints criteria:

	Favourable
	Neutral
	Less Favourable

Table 5.16.1: Overview of Engineering Options for Mainline Options

Constraints	**Mainline**		
	1	**1a**	**2**
Local Roads and Access			
Standards			
Topography and Land Use			
Hydrology			
Geotechnics and Earthworks			
Structures			
Public Utilities			
Constructability			
Operation and Maintenance			
Non-Motorised Users			

Table 5.16.2: Overview of Engineering Options for Aviemore South Junction

Constraints	**Aviemore South**		
	A02	**A09**	**A18**
Local Roads and Access			
Standards			
Topography and Land User			
Hydrology			
Geotechnics and Earthworks			
Structures			
Public Utilities			
Constructability			
Operation and Maintenance			
Non-Motorised Users			

Table 5.16.3: Overview of Engineering Options for Granish Junction

Constraints	Granish			
	C18	C21	C31	C34
Local Roads and Access				
Standards				
Topography and Land User				
Hydrology				
Geotechnics and Earthworks				
Structures				
Public Utilities				
Constructability				
Operation and Maintenance				
Non-Motorised Users				

Table 5.16.4: Overview of Engineering Options for Black Mount Junction

Constraints	Black Mount					
	D02	D03	D07	D12	D13	D51
Local Roads and Access						
Standards						
Topography and Land User						
Hydrology						
Geotechnics and Earthworks						
Structures						
Public Utilities						
Constructability						
Operation and Maintenance						
Non-Motorised Users						

5.17. References

5-1 Option Sifting Document AP12-AMJ-GEN-X_ZZZZZ_ZZ-RP-ZZ-002.
5-2 SUDS Manual, CIRIA C753 (CIRIA, 2016).
5-3 Regulatory Method (WAT-RM-08) Sustainable Urban Drainage Systems (SUDS or SUD Systems) (SEPA, Version:v6 2016).
5-4 Engineering in the water environment: good practice guide', SEPA.